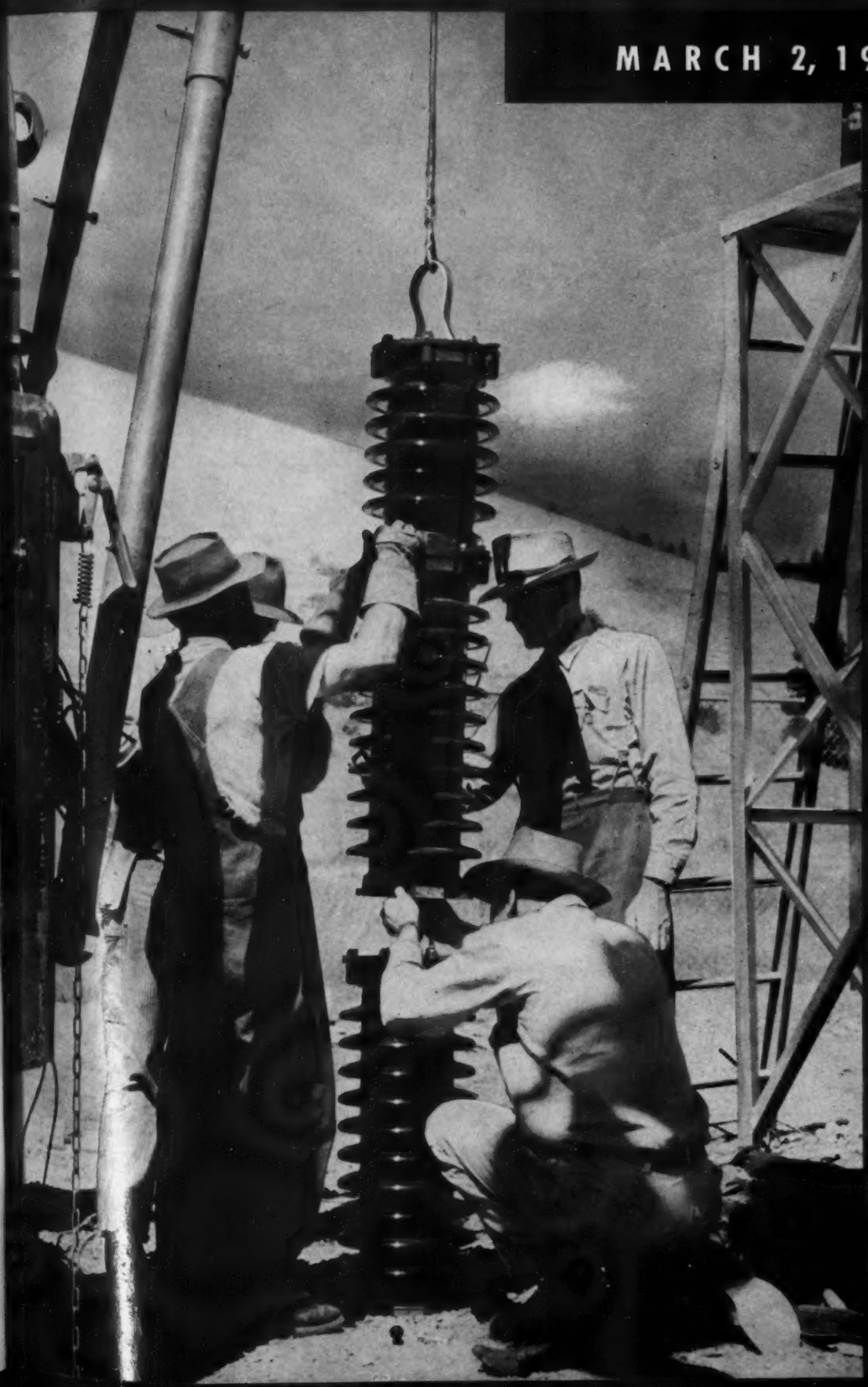
Electrical World

MARCH 2, 1946



Secondary Banking with Automatic Sectionalizing

Thermal Demand Test Methods

Carrier Characteristics

Field assembly of carrier coupling capacitor

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Electrical World

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March 2, 1946 — Vol. 125, No. 9

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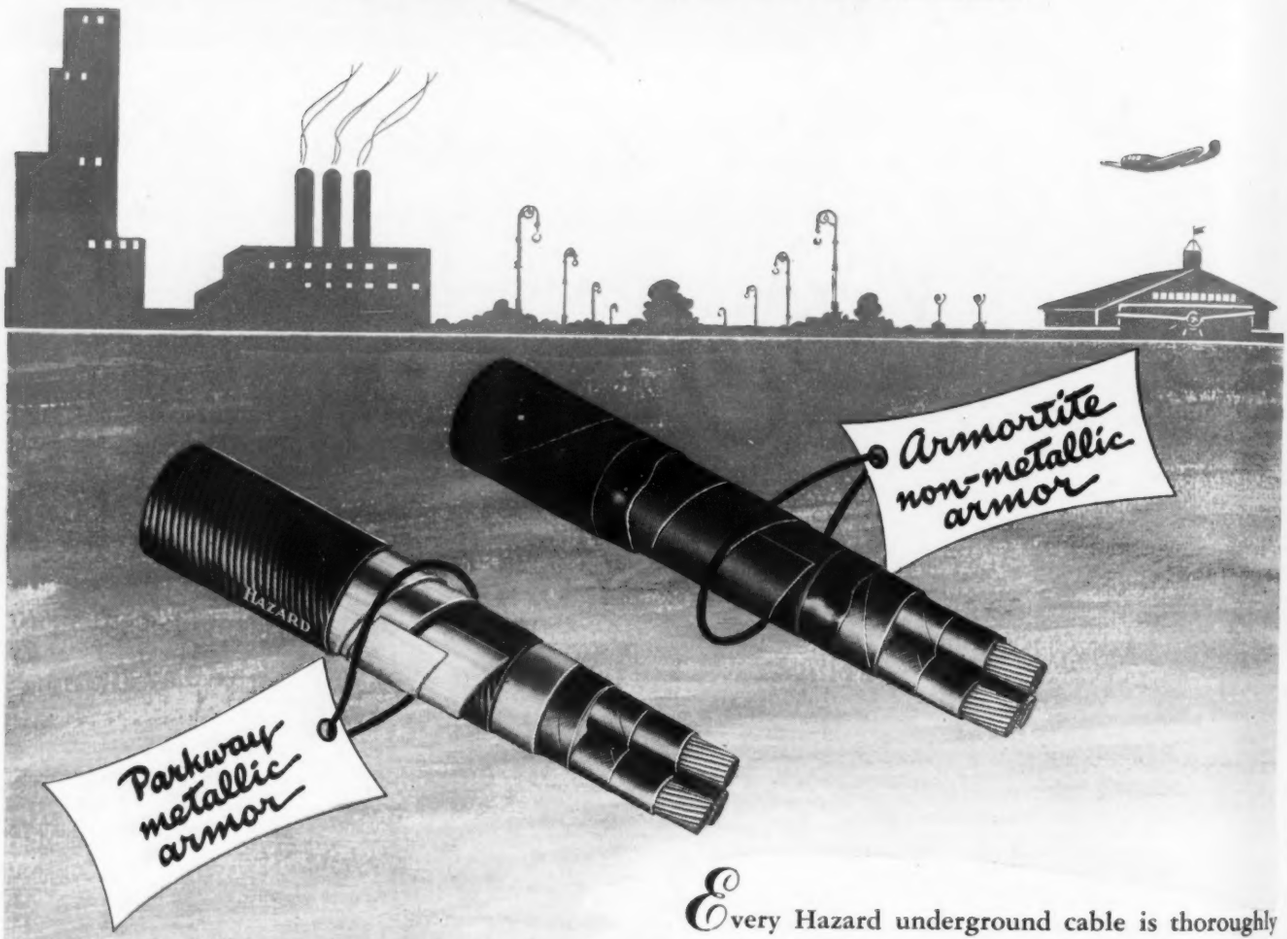

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THE PRESIDENT'S WAGE-PRICE POLICY WON'T WORK

THE AMERICAN public had every right to expect that the long-awaited wage and price policy would break the impasse blocking the way to the swift and orderly reconversion of industry from war to peace.

The policy announced offers little promise of such solution, and this may well constitute a national calamity.

There is only one thoroughly constructive feature of the Presidential Statement of February 14 and its implementing Executive Order. It is the first Government pronouncement since the defeat of Japan to clearly define inflation as the major danger confronting us in the period immediately ahead.

That is a correct appraisal, and one long overdue. Up to now Government spokesmen, almost invariably, have sought to carry water on both shoulders. The Administration has justified its policy of promoting wage increases as a measure necessary to forestall deflation — to keep purchasing power from falling and forcing the economy into a violent tailspin. The strict holding-of-the-line on price ceilings has been defended as necessary to prevent runaway inflation. Unfortunately, while the President now exhorts all to enlist in a crusade against inflation with a voice that is clearly Jacob's, his program for dealing with it still employs the hairy hands of Esau to promote the very danger which he is urging everyone else to combat.

The "new" policy provides for a continuation of the wage increases that have been pressured through by Government mediators, "fact-finding" boards, and direct seizures until they have been made general throughout industry upon the dimension established in recent patterns. It offers industry the single concession of prompt hearings and decisions upon claims for price advances, but the yardsticks for judging such claims are exactly those which OPA has applied in the past. Since the past procedure has led us into our present difficulties, it is hard to see how it will serve now to lead us out of them.

Past Government Policy Fostered Dissension

At the war's end, it was obvious to everyone that what was needed was the swiftest possible reconversion of industry. It should have been equally apparent that we were faced with the difficult problem of controlling tremendous inflationary pressures which would be particularly insistent until peacetime production could be mobilized at high volume. This was made almost inevitable by the huge backlog of accumulated demand, for both capital and consumer goods, and by the unprecedented volume of liquid funds at the disposal of individuals of all classes. The only circumstance that could have modified the inflationary complexion of the postwar picture was the possibility of such wholesale and prolonged dislocation and unemployment in the process of readjustment that people would have been frightened into freezing onto their savings instead of spending them.

It soon was apparent that just the opposite was taking place. The early transition was extraordinarily swift, unemployment was lower than anyone had dared hope, and civilian spending outstripped all previous records. The circumstances called for strong anti-inflationary fiscal measures, along with a firm maintenance of price and wage controls alike.

Instead of adopting such a balanced program, the Government immediately discarded all wage controls, and in addition started an active campaign for promoting large wage increases. The President, upon a number of occasions stated flatly that American industry generally could and should grant substantial pay advances without any compensating price rises. His Office of War Mobilization and Reconversion estimated that average increases were practicable to the extent of 24 per cent. Given such Governmental encouragement, it was inevitable that labor leaders should do exactly what they did—file extravagant wage demands at the beginning of the reconversion process, when accurate appraisal of production schedules and costs were least susceptible of calculation, and when the shortage of civilian goods multiplied the inflationary effect of any increase in purchasing power.

At the same time, the OPA was fighting to hold the price line in a good cause, but with singularly inept procedure. It acted, seemingly, upon the premise that it was always better to give less price relief than was needed rather than enough, that relief provided under its formula was preferably to be granted later rather than on time, and that the interests of lower-bracket income receivers should be protected by a particularly tough resistance to raising prices of cheaper goods. The latter procedure seems to have boomeranged by virtually driving many of the lower-priced lines off the market.

The sum of these wage-price procedures resulted in work-stoppages of epidemic scope. Many business concerns faced with the prospect of immediately unprofitable operation, uncertain that new wage demands would not be made with Government support as soon as volume production was established, and without assurance as to when price controls would end, refused to assume inevitable losses even when confronted with combined union and Government pressure. The fight was on.

"New" Policy Differs Little From Old

With inflation now clearly recognized as the immediate danger, it might have been expected that the new wage policy would reverse the former practise of lending active encouragement to new wage advances. But that would have brought down upon the Administration the wrath of all organized workers who had not yet been granted increases already bargained through by other groups. This was avoided by directing the National Wage Stabilization Board in effect to approve any wage increases necessary to give general advances comparable to those already made. The only brake applied on the wage side lies in a directive to the Board not to approve, as a basis

for price relief, wage advances that go beyond the established pattern.

On the price side, the new directives to the OPA entail no important departure from its past procedures. Even the concession to review "hardship" cases promptly rather than after six months is only a pious hope, since it is unlikely that OPA is equipped to deal rapidly with the thousands of cases that will arise. A hardship case is defined as one in which, after absorbing an approved wage advance, an industry or establishment in a twelve months' period of normal-rate operation is judged by the Price Administrator likely to operate at a rate of profits to net worth less than it averaged in the base period of 1936-1939.

Let us see what this really means. In the first place, the rate of manufacturing profits in the base period was only moderate. But since the average net worth of manufacturing corporations has increased one-third over what it was in the base period, the application of the OPA formula, *assuming that its Administrator correctly appraises the twelve-month outlook,* seems to provide for absolute profits one-third higher than the 1936-1939 average.

The OPA formula, however, applies to profits *before taxes.* What really matters to stockholders is profits *after taxes.* Corporation taxes have been increased from an average of 17 per cent in the base period to 38 per cent now. This means that the price adjustments granted by OPA on average will yield profits *after taxes* no larger in dollar terms than in the 1936-1939 period, although 1946 manufacturing sales are expected to be more than twice as high. Under this procedure the *ratio* to net worth of profits *after taxes* will be one-fourth lower than the 1936-39 average. This clearly undermines the incentives upon which production at high level depends.

The workers get wage increases which promote inflation. The Government, bailed out from its previous mistakes, gets political credit for raising wages. And the entire bill is handed to American industry for payment.

But the Danger of Inflation is Real

Under these circumstances, there is a growing demand on the part of business groups that price controls be rescinded immediately. It is argued that, once the restrictive influence of price controls is relaxed, capacity production soon will supply sufficient goods to prevent undue price inflation.

It is understandable that business should wish to be rid of Government controls which have operated in such a thoroughly inconsistent and damaging fashion. Unfortunately, there is ground for believing that more harm might result from this cure than from the disease.

There is nothing in our situation that could bring on the kind of inflation that has been experienced by certain countries of Europe and Asia—in which the value of currency deteriorates until it takes a cartload to buy a pair of shoes. But our situation now is definitely more threatening than it was in 1919, after the first World War. At that time wholesale prices and the cost-of-living skyrocketed almost 25 per cent within twelve months. If we discard all controls now, as we did then, prices might easily go up from 25 to 50 per cent in a year's time.

An inflation of that dimension can do tremendous damage. While it lasts, all those dependent upon fixed incomes are damaged—all bondholders, including those who hold war bonds, all life insurance and annuity beneficiaries, all pensioners. Generally, the purchasing power of wages and salaries would shrink, with white collar and unorganized production workers hardest hit. Controlled-rate industries, such as railways and other utilities, would be squeezed. General business would suffer least of all—while the boom lasted.

But such soaring booms cannot last. The 1919 boom burst in mid-1920. By summer of 1921 industrial prices had fallen 40 per cent and industrial production was off 35 per cent; farm prices had fallen 50 per cent. This time the boom might soar higher and last longer, but that would merely result in an even more precipitous drop. Business would be hard hit along with everyone else, and high wage rates would mean nothing to the unemployed.

Controls Must be Consistent and Progressively Relaxed

But if the Nation cannot afford to risk disastrous inflation by immediately abolishing controls, neither can business afford to accept the program which the Administration now proposes.

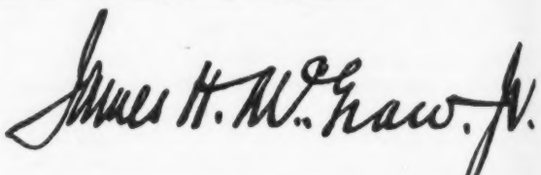
The wage-price policy will not hold the inflation line so long as the Administration is leading the assault to breach that line on the wage side, as it has done ever since VJ-Day.

The Administration is now going before Congress to ask for a broad extension of its wartime powers for an additional year beyond June, 1946.

Congress must see that this is not granted except upon terms that guarantee the use of such power with a consistency that has been conspicuously absent up to now.

1. It must provide sufficient price relief to yield profits normal to high-level operation.
2. The basis for price relief must be clearly defined and geared to actual costs of operation at the earliest possible date.
3. OPA administrative procedures must be speeded-up and streamlined, or the delays that characterized past administration will become intolerable.
4. It must see that, once established, the new line is held as long as wartime controls are continued by enforcing restrictions on wages as well as prices.
5. It must set an early date for the termination of all wartime controls and provide for progressive and bold steps for de-control to be taken before that date, as soon as production levels in any field are sufficiently high to restrain runaway prices.
6. It must proceed without delay to marshal fiscal and monetary policies to combat inflation, in order that price controls may be discarded at the earliest possible date.

Unless Congress does this—and it will not be easy in an election year—we are headed for an explosion. It will come in one of two forms—either in a continuance of industrial strife, or in a rocketing inflationary boom that can only end in collapse and depression.



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Electrical World

MARCH 2, 1946

A Voice for Engineering

ONCE MORE there is agitation for a national organization that can speak for all branches of engineering. It is not easy, however, to understand what is at the bottom of the movement except perhaps a restless realization that engineering is rapidly becoming specialized and tends, therefore, more and more to lack unity.

In the two great professions of law and medicine there is as much if not more specialization, yet there is a common bond whieh gives to them a degree of unity on matters affecting all segments of those professions. Engineering on the other hand has no such common bond except perhaps registration, for which problem there is an effective national organization.

In all the discussions we have heard so far there have been no clear cut expressions of what is expected of an over-all national engineering society, how it can achieve the unity that is desired or how it can truly be the voice of all engineering. What are the national problems on which engineering wishes to be heard? Are they problems on which a national association can have an opinion that will generally be acceptable to the rank and file of engineers of widely different interests and training? What in other words, can such a national society of engineers do that a council sponsored by the officers of the four founder societies cannot now do?

With law and medicine the national societies act not only to protect the profession but are of great public service as well. What additional public services can a national engineering society perform that is not possible with the present set-up? Standards are the great public benefit emanating from such organizations but we wonder what an over-all engineering body could do better than is now being done by American Standards Association.

At the grass roots level, however, there is plenty for an over-all engineering society to do. Not only can such a local body make it possible in other than metropolitan areas for small sections of national societies to operate efficiently and well within a limited budget but by providing common quarters and bulletin service can build up a close bond between engineers. Moreover, such local groups can gain great prestige for the profession of engineering by performing public services in the name of engineering.

A local body for instance can assist the community in city planning, in problems of sewage disposal or street lighting, in helping the schools advise students expecting to study engineering and in countless other ways where sound professional advice is greatly needed. In that way engineers can fulfill their obligations of citizenship and build prestige for the profession.

It is from such grass roots that a demand for a national over-all organization of engineers should spring, because it is there that we see the practical results of professional unity.

When the demand does come it will be recognized for it will carry with it a clear cut picture not only of what such an over-all body could do for engineering but an equally clear picture of what engineering can contribute nationally to the public welfare.

Utility industry statement on

Atomic Energy as a Source of Electricity Supply

THE MERE TECHNIQUE of utilization poses questions of the first magnitude. The ability to transform nuclear energy into heat in unconventional boilers—which, with quite incomplete knowledge on the committee's part, seems to be the most probable process—and to do that without risk either to plant personnel or to the general public; to develop efficient systems of control; to find the materials most suited to such operations and to carry them through engineering development and construction will require a high degree of collaboration extending well beyond the abilities and the available time of any committee of five men. The committee therefore will seek, subject to their approval and willingness to cooperate, the assistance and advice not only of scientists and engineers but of the departments of government so far as it appropriately may be extended. It will also seek to enlist the talent of manufacturers.

This prepared statement was made before the Senate Committee on Atomic Energy by the Association of Edison Illuminating Companies' special committee on appraisal of atomic energy as a source of electricity supply, which is under the chairmanship of J. C. Parker, vice-president, Consolidated Edison Company of New York and past president, A.I.E.E. The other four members are:

A. D. Bailey, executive vice-president, Commonwealth Edison Company, Chicago, and past president, A.S.M.E.

K. M. Irwin, manager engineering department, Philadelphia Electric Company, and chairman of the Association's power generating committee.

J. W. Parker, president, Detroit Edison Company, and past president, A.S.M.E.

Philip Sporn, executive vice-president, American Gas and Electric Service Corporation, and 1946 Edison Medalist, A.I.E.E.

Offers to Collaborate with Navy

It appears now that the two most likely fields of energy utilization are to be found in marine propulsion and in large land power plants. The committee, therefore, proposes to offer to the United States Navy such collaboration as the Navy finds to be consistent with the purposes of national security. It is possible that, as was the case with higher pressure and higher temperature steam development, large land installations may afford an excellent proving-ground for the exacting requirements of the naval service.

The senators are aware, of course, that not only the operating costs but the investment in new types of boiler equipment are important to the successful service of the public. It will be necessary therefore for the committee to estimate the minimal costs at which equipment may be provided for transforming nuclear energy into the heat in steam or perhaps other media for use in heat engines.

Beyond this there is a remote possibility that, at some future date, some fraction of the energy available within the atom may be released directly in the form of electrical energy with the intervention of equipment other than heat engines. This and the way in which such direct transformation may be correlated with thermal processes require open-minded investigation.

However, regardless of the route by which it is achieved, anything that will reduce the cost of production of electrical energy is none-the-less of benefit to the national economy, and will become an object of assiduous research and investigation by this committee. It is proper to point out, however, that zealously though the industry will seek to develop the possibilities, revolutionary results in the cost of supplying the public are not to be expected but rather sober, level-headed betterment. The reason for that is worth pointing out.

Most of the investment and much of the operating cost of present systems lie outside the generating plants—for example, in the distributing systems and in the multifarious services to customers. There is no present indication that atomic energy will relieve that major element in cost.

It is evident, if this preliminary hypothesis proves correct, that the primary advantage to the national economy through such use of nuclear energy will be in the service of that part of the utility load in which fuel costs play the relatively biggest parts, namely, industrial and heavy traction load, and that the economies here will probably be not much greater than the difference in fuel cost.

Limited though those economies may be, the committee, and the Edison Association which it represents, believe them to be of importance to the industrial development of the country. They believe that whatever body is set up to administer the distribution of fissionable materials well might require that such economies be passed on to the consumers conformably with the determinations of the local regulatory authority. Such economies, of course, should be the net economies giving due weight to new investment occasioned by a new type of boiler or other conversion equipment.

Amount of Energy Available

There has been some popular misconception as to the amount of energy that would become available through atomic processes. A clear perspective in this matter is to be had from a realization that never at any time has the country suffered from a deficiency in the amount of power available. Indeed it seems clear that the ultimate supply of energy available from coal and from waterpower is more than sufficient for all the probable needs of the country for centuries to come. All that is necessary vastly to expand the availability of electrical power is the construction of plants, transmission and distribution systems. Even more significant, however, are the much more expensive plants and devices for utilization. All this will be the case whether the source of energy is the newly understood atom or the more conventional sources. It is true that some expansion of elec-

tric energy use may result from the development of atomic energy in so far as such development brings about a reduction in cost of generation and, therefore, make possible the electrification of certain large scale chemical or metallurgical processes now carried out on a thermal basis. But that, if at all, will occur only after an extended period and as it proves economical.

Attitude on Obsolescence

Another popular misconception which must be mentioned in order to make clear the attitude of the public utilities is the thought that they might be unduly apprehensive of the incipient obsolescence of their plant and property by a new technique. If the present probabilities develop, namely, that nuclear energy will be used in the production of steam for high temperature turbines, the process will be highly analogous to a current one quite common to the light and power industry, namely, the use of so-called topping turbines. When new and more efficient heat cycles, using much higher steam pressures and temperatures, became available the utilities companies recognized the possibility of removing some or all of their older boilers, of producing steam at high temperature and high pressure and then, in new turbo-generator sets, while doing useful work, degrading it to the level formerly produced in the lower pressure, lower temperature boilers and further using it in the existing turbines. A strictly analgous process seems quite probable when and if the technical and economic problems of atomic energy utilization are worked out. Old boiler plant and combustion equipment may be removed, giving place to the newer type of boiler, with or without its own high pressure, high temperature turbine. Thus steam would be produced for use in the present turbo-generators either directly or through the intervention of an atomic topping turbine.

Even should some appreciable part of the atomic energy ultimately be found capable of direct conversion to the electrical form it would work as one horse of a two animal team, the other being the heat process, both in parallel supplying power to central station bus bars. But this prospect does not appall either the committee or the industry. On the contrary, the industry will welcome and seeks to aid the development of any attractive possibilities in nuclear power production quite as it has the development of improved combustion processes and more favorable steam cycles.

When it becomes reasonably certain that sound economic advantage will result from atomic sources it is fully expected that the rate of increase of central station energy utilization will make possible the introduction of atomic "toppers" for base load purposes, that is for energy production round the clock so that the fullest operating advantage may be had from the replacement of the current conventional practices. On the other hand it seems equally probable that the cost of new equipment will not be warranted or if so in lesser degree by that part of the load which is of short duration. Thus, much of the unconverted present conventional equipment will represent the most realistically economical method of meeting the requirements of the community and will therefore have an undisturbed usefulness through its natural physical life.

No Obstacles to Full Exploration

For these reasons combined with the necessity for continuing our present and highly significant systems of transmission and distribution there is no reason why the industry should be alarmed by any consideration of obsolescence. Indeed were the economic attractions of atomic energy in the course of time to prove so great that even peak load and reserve equipment would be forced into the scrap heap that fact in itself would say that there were advantages sufficient to warrant—indeed to make welcome—the processes of supersession. The committee thus feels that there are no obstacles, tangible or otherwise, to its full and open-minded exploration of the possibilities inherent in atomic energy to develop a more economical system of electric energy supply and more widespread use of electrcial energy to enhance and stimulate the national economy.

In this connection the public utility industry of the country has only one reservation and that is that atomic materials should be available for industrial use without differentiation as to the type of utility to which it is made available and with the single collateral requirement that any resultant net economies be passed on to the consumers under the supervision of regulatory authorities on the local level.

As an association we completely endorse the theory that the processing of such materials for use must be under the control of some such commission as it is proposed in the Bill under discussion. The possibilities of misuse under any other scheme of production are too ghastly to be contemplated. As a collateral of such control, licenses for use seem quite inevitable. Such licenses for all uses whatsoever obviously must be surrounded by safeguards against injury to life and health. These safeguards quite clearly must be uniform and effective.

The Association of Edison Illuminating Companies regards as of distinctly minor significance any question of patent rights that may result from the studies of this committee or subsequent development committees. It is, none-the-less, speaking for itself as an association, very glad to say here that all of the results of the Association's developmental work will be widely disseminated. In so far as they are reflected by patents granted, they will be made available to others on a reasonable, non-exclusive licensing basis. It would consider it proper, and would be glad to agree, that such licensing processes and fees be regulated by an appropriately constituted governmental agency. In making this declaration of policy the Association does not, of course, assume to control the otherwise legal conduct of individuals, particularly those engaged in making apparatus and machinery.

Summary

In brief summary, the industry, for whose oldest association I speak, is keenly and constructively interested in the peaceful uses of atomic energy for the benefits of the users of electrical power throughout the country whether on the systems of its member companies or otherwise; is at the present time, like most of the American public, not sufficiently informed of the basic facts to be able to make any sound forecasts; seeks such fuller knowledge as may properly come to it and is committed to the aggressive prosecution of all favorable possibilities by the application of its technical and economic resources.

Secondary Banking With Automatic Sectionalizing

Modified CSP transformer incorporating thermally controlled breakers provides overload protection and automatic fault isolation on banked secondaries—Field experience and fault tests show practicability of network protector principle used—An installation of six transformers

JOHN S. RULE, Pacific Gas and Electric Co., Oakland, Calif.

PRACTICE of secondary transformer banking in overhead distribution, despite its many economic and operating advantages, and the many fusing schemes employed, has been generally retarded throughout the industry because of the lack of economical automatic sectionalizing devices.

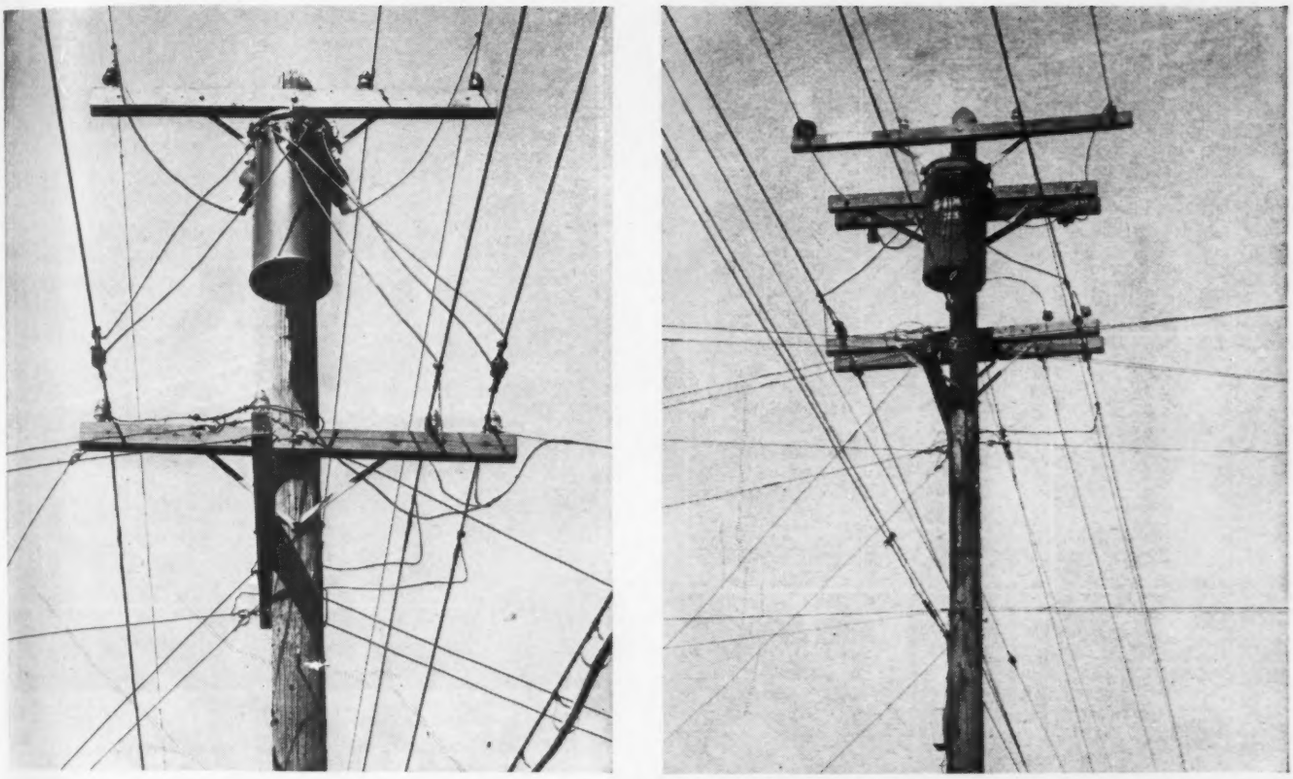
The benefits of banking—better voltage regulation, greater diversity of load between transformers, minified light-flicker, possible use of smaller conductors than in a radial secondary—have long been recognized. The extent to which protection should be afforded in preventing service interruptions from cascading, and transformer burnouts, has been the subject of much discussion* and difference of opinion.

Banking of transformers supplied from 4,160-volt overhead primaries has been practiced in urban districts and built-up rural districts for many years by the East Bay Division of the Pacific Gas and Electric Company. Type of banking used has depended largely upon the layout of streets. Many banks are of the straight-line type, but whenever street arrangement permits, secondaries are connected into a loop or grid because of the greater advantages obtained.

Protection for these banks has been of the simplest kind, consisting of primary fuses alone with fusing at approximately 1 amp. per kva. of trans-

HEAVY PALM tree branches create severe fault conditions for trial installation of automatic sectionalizing in secondary banking practice. Large leaves droop over the conductors, wearing off insulation and causing short-circuits on secondaries and services

* A very able discussion of coordinated fuse protection for secondary banking was presented in July 7, 1945, ELECTRICAL WORLD, "Banked Secondary Stages a Comeback" by R. R. Menard.



CONVENTIONAL distribution transformer (right) is replaced with modified CSP transformer (left). Pole top is simplified

former capacity. Banks have been kept to a moderate size to avoid unbalancing the three phases of the primary circuit.

In residential districts the practice has been to limit the number of banked transformers to four, and the capacity of such banks to about 75 kva. In business districts, only two or three transformers are banked but capacities may run up to 100 kva. or more. These conditions do not apply in areas supplied from underground feeders.

Primary Fusing

No protection against cascading is provided in this system of banking and there is the possibility that all the transformer primary fuses may blow or an occasional transformer burnout result, causing an outage of considerable time and extent. In this simple system of banking with primary fusing only, the use of these smaller banks make fault conditions less troublesome and service can be restored in a much shorter time when an outage does occur.

Balancing of primary feeders, difficulties encountered in restoring service, and similar factors will usually determine the bank size. The degree to which refinements of protection are economically justified depends almost entirely on the number of interruptions expected. In some localities the practice of primary fusing only may suffice; in others more elaborate protection is essential. There is little doubt that the simple protective system used generally in this area has been workable only because of the very favorable weather conditions. Temperatures seldom drop below freezing for more than a few hours at a time, so ice conditions are not bothersome; and during any year there are comparatively few severe stormy days accompanied by heavy winds. Exposure of the feeder to lightning averages less than once per year per feeder and is considered of almost negligible concern in the urban districts where most of the transformer banking is done. Nevertheless, a considerable number of interruptions do occur from weather and other causes. While many of these interruptions involve the entire primary circuits, a study of interruptions on secondary banks indicates that considerable thought should be given to means of improving service.

Early in 1944 a trial installation of six 15-kva. Westinghouse special CSP (completely self protected) transformers incorporating an additional circuit breaker for secondary banking was made in the City of Piedmont. The location selected was a residential section of somewhat greater-than-average load density. The area contains a great number of very tall fan palm trees on both sides of the street. These palm trees, as shown in one of the accompanying illustrations, have been the source of service interruptions for many years. The large heavy leaves droop over primary and secondary wires, wearing off insulation and causing the secondaries and services to short, resulting in blown primary fuses and long outages. Secondary protection is a definite need under such conditions.

This location afforded an excellent opportunity to test the automatic sectionalizing and protective features of these new transformers under adverse fault conditions. The load cycle in the location selected is similar to that of the average residential district, that is, a moderate daytime load with typical evening peak. The short-time overload characteristics of CSP transformers are ideally suited to this type of load.

Information obtained prior to the installation indicated that a springtime evening peak of about 100 kva.

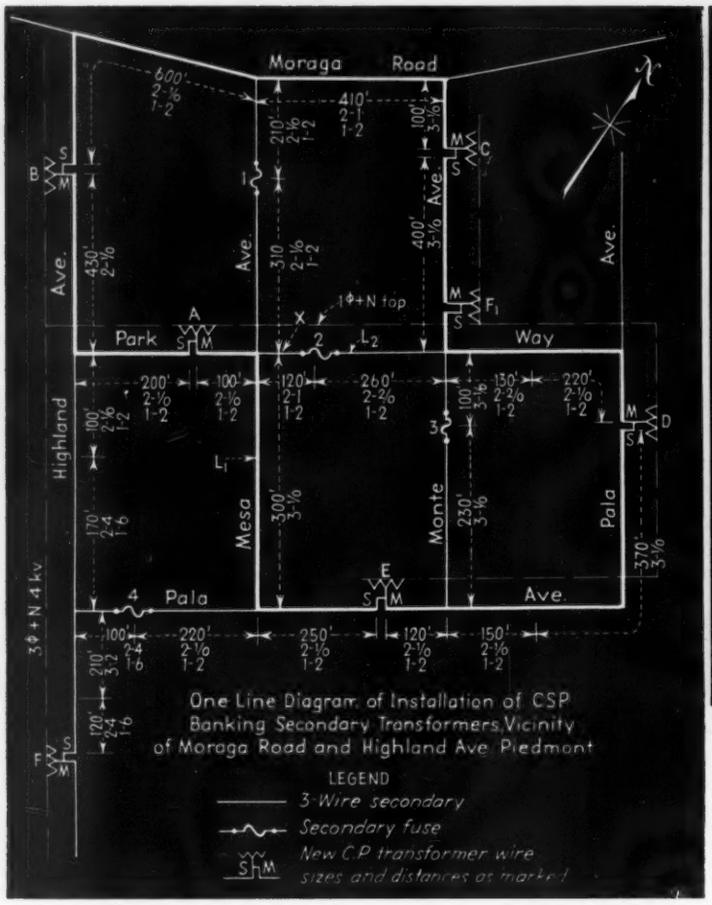


FIG. 1—Circuit layout of secondary grid where trial installation of breaker-type distribution transformers was made

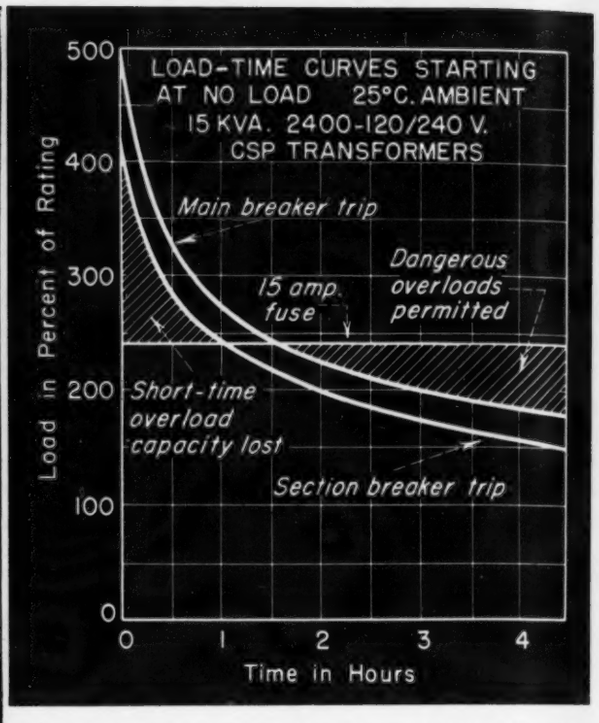

LOAD-TIME CURVES STARTING AT NO LOAD 25°C. AMBIENT
15 KVA. 2400-120/240 V. CSP TRANSFORMERS
Main breaker trip
Dangerous overloads permitted
15 amp. fuse
Short-time overload capacity lost
Section breaker trip
Load in Percent of Rating
Time in Hours

FIG. 3—Load-time curves for 15-kva., 2,400-120/240-volt CSP transformers showing the short time overload capacity lost with presence of primary fusing

could be expected for the proposed bank and that the anticipated winter evening peak load would be approximately 50 percent greater. Accordingly an installation of six 15-kva. transformers (90-kva. total) would provide the abnormal overload condition desired for the trial installation.

In setting up the installation, the six 15-kva. transformers at locations shown in Fig. 1 replaced seven conventional type transformers totalling 147½ kva. which had been operating in smaller banks with primary fuse protection only. Only minor changes were required in construction of the existing primaries and secondaries in order to make the change.

The primary circuit is shown by dashed lines, secondary loop by heavy solid lines, and the closing section of the grid by light solid lines. Secondary conductors are for the most part two No. 1/0 with No. 2 neutral.

Transformers A, B, C, D, and E were connected in a looped secondary bank as indicated by heavy line. To study the benefits of grid connection of this secondary bank, four sets of 25-amp. sectionalizing or grid-tie fuses were installed at locations 1, 2, 3, and 4. These 25-amp. fuses were to assure fast clearing and permit conversion of the grid to a loop in the event of a fault.

Transformer F secondary was outside the loop pattern and was tied into the loop-grid bank as indicated to observe operation under all conditions of banking.

Transformer Features

The special CSP transformers in this installation are not equipped with deion arrester surge protection because lightning protection is not considered necessary in the area. This type of transformer is commonly designated CP (current protected). They incorporate other standard features of the CSP; i.e., built-in primary protective

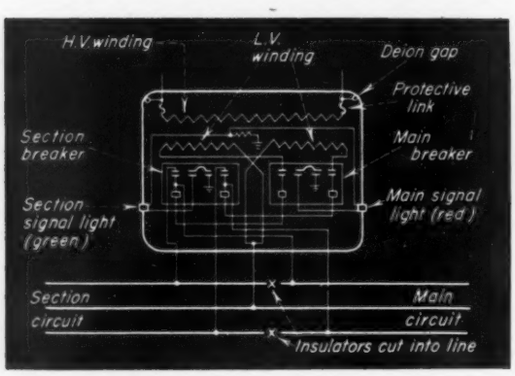
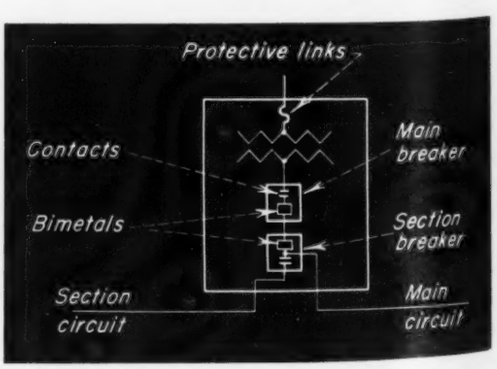


FIG. 2—Connections of new CSP transformer (left, schematic right) designed for banked secondary operation



links to clear the transformer from the feeder in case of an internal transformer fault; a secondary breaker to provide protection from secondary short circuits and dangerous overloads (this breaker is referred to as the "Main Breaker"). Special features provided for secondary banking include an additional secondary breaker located in the transformer oil adjacent to the "Main Breaker" and electrically connected as shown in Fig. 2. This secondary breaker is referred to as the "Section Breaker." Protective links, which eliminate the use of primary fuse cutouts are connected in series with the primary windings of the transformer between the winding and the bushing leads.

The secondary breakers connected between the low-voltage winding and the low-voltage bushing, as shown, have inverse characteristics obtained through bimetallic controlling elements, whose temperature variations closely follow variation in the temperature of the transformer coils. This gives an accurate overload control, protecting the windings from failure due to excessive heating. The bimetals are made to follow coil temperature by locating them under the oil and passing the load current through them. Load current from each half of the low-voltage winding passes through one of the two bimetals in each breaker. Deflection of either bimetal to point of tripping opens both poles of the breaker, interrupting the load current from both halves of the low-voltage winding. In this manner both coils of the low-voltage winding are protected against excessive temperature. This protection is thus reflected to the high-voltage winding.

Breaker Calibrations

The main breaker is calibrated to trip at the same values as the breaker in the standard CSP transformer as shown by the upper load-time curve of Fig. 3. The section breaker is calibrated to trip at slightly lower values than the main breaker. When these secondary breakers trip, signal light circuits are energized as indicated in Fig. 2, from a special winding in the transformer. Signal lights are part of the corresponding externally operated breaker handles. The lights are lit as the corresponding breakers are tripped from overloads or short circuits. Both lights remain lit until automatically reset by the manual closing of their corresponding breakers.

The advantage of a thermally controlled secondary breaker over a fuse is that tripping of the breaker is dependent on load current and oil temperature, while the fuse is a current-limiting device and for all practical purposes will blow at a definite current value. The primary fuse can protect only against a predetermined current in the primary winding, but even this does not afford the same protection to the coils of the low-voltage winding under balanced and unbalanced load conditions.

With conventional transformers, selection of a primary fuse large enough to take advantage of safe short-time overloads will also permit dangerous overloads. A fuse rated near full-load current of the transformer will not make safe short-time overload capacity available. These conditions are illustrated in Fig. 3 where the protection afforded a 15-kva. transformer with a 15-amp. primary fuse is compared with the load-time curve of the thermally controlled secondary breakers.

Artificial Fault Tests

To demonstrate operation of this secondary banking and to familiarize company personnel with characteristics of the transformers under fault conditions, several secondary short circuits and fault tests were made in April, 1944, about one month after the trial installation was completed. Before describing these tests, the circuit connections of the transformers and the loop will be mentioned. The transformers have five low-voltage terminals, one for the neutral, and the others for connection from the built-in secondary breakers to the 3-wire secondary as shown in the upper part of Fig. 2. The section breaker is connected to a part of the loop designated as the "Section Circuit." This becomes common with the "Main Circuit" of the next adjacent transformer as they are banked throughout the loop, as shown schematically in Fig. 1. The transformer F, connected outside the loop, has its "Section Breaker" connected against the loop as indicated.

For test purposes a 400-amp. enclosed knife switch was installed at street level on the corner pole at "X," Fig. 1. This fault switch was connected between a secondary leg and neutral at that location through about 60 ft. of No. 4/0 wire. Test lamps were connected to the secondary on Mesa Ave. at location "L-1" and on Park Way at location "L-2." Recording voltmeters were installed on customers' services at approximately the same locations.

Tests were made with and without external impedance connected in the fault circuit to simulate fault conditions of different impedance. Without external impedance, fault currents estimated at more than 1,500 amp. blew 25-amp. grid-tie fuses instantaneously at locations 1, 2, and 4 (Fig. 1). Fuses at location 2 opened both hot legs of the 3-wire secondary while only the fuse in the faulted hot-leg opened at locations 1 and 4. Considerably more power was supplied to the fault with the grid closed on this test than on subsequent tests when over half of the grid was converted to a loop by blowing of fuses at locations 1, 2, and 4.

With external impedance of 0.092 ohms and with 850 amp. in the fault circuit, the section breaker of transformer A tripped in 4.6 sec. The main breaker on this transformer then tripped, in 5.6 sec., clearing the transformer from the faulted section. Section breaker of transformer E tripped in about 8 sec., thus clearing the other

Load Data on the Six 15-kva. Breaker-Type CSP Transformers Used in Trial Secondary Banking Installation

	April 1944 Peak Load			December 1944 Peak Load			February 1945 Peak Load*		
15 Kva. Transformers	Kva.	Percent of Rating	Percent Load on Two Secondary Windings	Kva.	Percent of Rating	Percent Load on Two Secondary Windings	Kva.	Percent of Rating	Percent Load on Two Secondary Windings
A	21.8	145	(150–141)	25.9	173	(163–183)	19.4	129	(131–128)
B	24.5	163	(160–166)	29.6	197	(185–208)	25.6	171	(160–183)
C	17.3	119	(135–103)	26.9	179	(153–204)	16.9	113	(119–108)
D	19.2	129	(135–122)	28.0	187	(208–167)	20.5	137	(140–135)
E	9.1	61	(45–77)	20.8	139	(170–108)	19.6	131	(176– 96)
F	14.9	100	(93–106)	17.6	117	(135–100)			
F_1							15.9	106	(112–100)

*Transformer F moved to new location F_1 to share increased loads on transformers A, C, and D.

end of the faulted section of the loop.

For the purpose of determining the best size of grid-tie fuses to employ under higher impedance fault conditions, a test was made with 50-amp. fuses. With external impedance of 0.370 ohms and resulting fault currents of about 300 amp., the 50-amp. fuses required five to seven minutes to blow. From this the conclusion was reached that grid-tie fuses should not be of too large capacity if the secondary grid was to be broken up quickly.

From results of these tests and from charts of the current flow through these grid-tie fuses, it was decided to continue to operate the bank with the 25-amp fuses. Maximum current values of 12 to 20 amp. were recorded through the grid-tie fuses by 24-hr. recording ammeter charts.

All tests showed proper functioning of the transformers, with service to the unfaulted portion of the loop being undisturbed.

Load checks made following completion of the installation and also during the 1944 winter peak and after relocation of one transformer in the bank are shown in the accompanying table. Total loading on this 90-kva. bank was 106.8 kva. or 119.5 percent in April, and 148.8 kva. or 165.3 percent in December. The December test was made following the first fault that occurred, and explains why transformers C and D dropped their load by breaker action as discussed later.

The above transformer load checks were made with a portable demand ammeter instrument of the thermal type requiring 30 min. of steady load to record the full load reading. Momentary current changes of short duration are not recorded. This ammeter was connected to the secondary leads of the transformers and left in place for 24 hr. in order to record the peak loading.

Operating Experience

Since its installation nearly two years ago this bank has given entirely satisfactory service. There have been four instances of transformer breaker operation in this time. A series of three of these cases occurred at the height of the 1944-45 winter evening peak load, and all involved the same portion of the bank. The fourth case occurred a year later.

On the evening of December 27, 1944, both breakers tripped on transformers C and D, and the section breaker tripped on transformer B, isolating secondary sections BC and CD. Secondary fuses had blown at locations 1, 2, and 3. The remainder of the bank was not interrupted, and service was restored to sections BC and CD by closing the open breakers. The cause of these breaker operations had not been determined when, on the following evening, the section breakers of transformers B and D tripped, resulting in dim lights but no service interruption. This was readily rectified by closing the two breakers.

Wind-Blown Branches

Field inspection revealed that several heavy palm leaves were lying over the secondary and service wires, pulling them close together, but there were no visible wire contacts. This condition, together with the holiday season loading, raised suspicions of local overloads or temporary short-circuits caused by wind blowing the palm leaves. A job order was issed to trim the palms and reduce the area of the bank by moving transformer F to Monte Ave. north of Park Way midway in the loop at F-1 between transformers C and D. Secondaries were to be opened at fuse location 4 and on Highland Ave. south of Park Way.

Before this work could be done, and on January 9, 1945, breaker operations occurred which were indentical with those of Dec. 27. Trees were trimmed and the bank rearranged at once, and no further operations took place until the following winter.

The fourth case occurred on the evening of December 10, 1945. Both breakers on transformer C and the section breaker of transformer B were found tripped with secondary section BC isolated and some secondary fuses blown. The rest of the bank was in service and this section of secondary was restored to service by closing the open breakers. The following day secondary wires were found pitted where they passed through a palm tree on Mesa Ave. just north of fuse location 1, indicating a temporary fault condition. This palm, as well as many others, was trimmed. No further service interruptions have been experienced.

The author has been informed that transformers now offered for this service have been further improved. The interconnection of the secondary breakers has been modified to clear a faulted or overloaded section of the secondary without loss of transformer capacity. The original bank capacity is left available to serve the unfaulted portion of the bank. With this improvement the outages on December 27, 1944, and January 9, 1945, might have been limited to one secondary section—BC or CD.

It is clear from the above record of transformer breaker operations, and findings upon field inspection, that service outages were kept to a minimum through the automatic isolation of faulted or locally overloaded sections of the bank. Furthermore, the signal light indications of the tripped breakers on the transformers aided the troublemen greatly in restoring service in a minimum of time.

Advantages

As a result of this trial installation, both under test and in service, it has been found that CSP transformers modified as described, have many advantages over conventional types. Some of these advantages are:

1. They will automatically sectionalize the circuit, isolating faults or dangerous overloads as is intended, before interruption occurs on the entire bank (cascading), and without damage to the transformers involved.

2. Time-delay in the operation of the transformer breakers prevent even localized outages under secondary short-circuit conditions of short duration, such as from swinging faults.

3. The transformers will carry heavy short-time overloads safely without compromise in long-time overload protection of the windings.

4. Service can be readily restored by the simple operation of closing the breaker levers, saving considerable time over that required to replace blown primary fuses and on some occasions breaking up the bank in order to restore it to service.

5. Troublemen familiar with these transformers like the simplicity of their operation, and the fact that a signal light, especially visible at night, indicates that the breaker on a particular transformer is open.

6. The work involved in installing and connecting this type of transformer, while slightly different than for the conventional type, does not create any particular difficulties, and appearance from a construction standpoint is neat.

Adaptation of Power Systems for Carrier Installations

Traps, bypasses, couplers are necessary for effective functioning of carrier systems—Resonant cancellation and stub-end reflections have to be circumvented—Effect on power-frequency impedances negligible

W. H. BLANKMEYER, Communication Engineer, The Montana Power Co., Butte

POWER MEN who are not directly concerned with carrier current application are often surprised at the array of coupling devices, line traps and other equipment attending this electronic field. Each device does, of course, have a clearly defined purpose, which is not always apparent from a casual study of the subject.

Even after completing the actual installation of these power-line-cluttering devices, the carrier engineer must make elaborate tests involving many switching operations and clearances, which are not always convenient, especially on heavily loaded systems. So perhaps a discussion of carrier background would clear the situation to some extent and it might possibly help some carrier engineers to stay in the good graces of men who are responsible for power systems.

A general answer to the unusual problems of carrier application is that carrier men frequently make installations in communication, relaying or telemetering, where variable and unpredictable factors are involved. Not all power systems present serious trouble in this respect, but where extensive carrier systems are applied to large power networks, these factors usually appear at one or more places.

Characteristics Uncertain

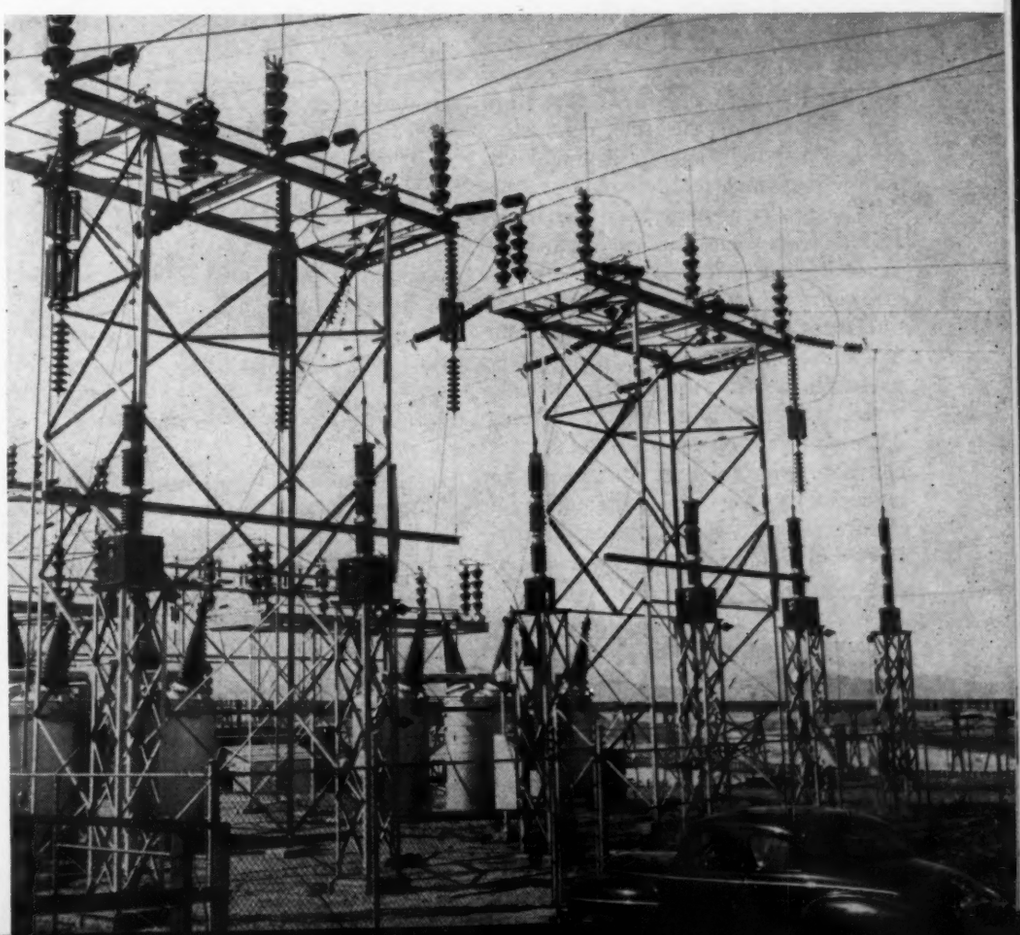
Power men naturally think in terms of their familiar subject and interpret results by those rules, but from outside appearances carrier does not seem to them to follow the same rules. When power equipment is installed, the characteristics are usually known or are at least easily established and there is little cause to question the efficiency or workability of the scheme.

In carrier the problem is not as simple. Seemingly minor differences in line lengths, the presence of branch lines or spurs, and equipment reactances combine to give characteristics which can be determined by test only. Since the combinations of lines and equipment often contribute to the overall characteristic, measurement of individual components may be valueless.

Regardless of the type of carrier transmitter and receiver or the purpose for which they are used, the equipment has about the same general function. The actual electronic circuits vary somewhat but the end results are similar with respect to the transmission problems in which the unpredictable factors appear.

All high-line carriers must have a line coupling device, usually the familiar high-voltage coupling capacitor which is simply a condenser capable of withstanding full line voltage and presenting an extremely high reactance at power frequency, usually 60 cycles. At carrier frequencies this reactance is much lower, but to achieve

FIG. 1—A battery of coupling capacitors and (behind and above them) line traps located at the junction of two 154-kv. lines. These units are used simultaneously on several carrier channels for telephone, relaying, load control and telemetering



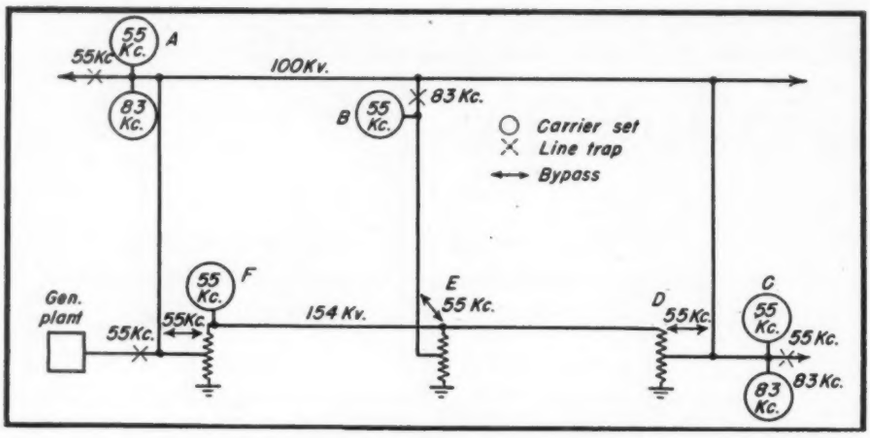


FIG. 2—Practical example of carrier cancellation until corrected by bypass adjustments

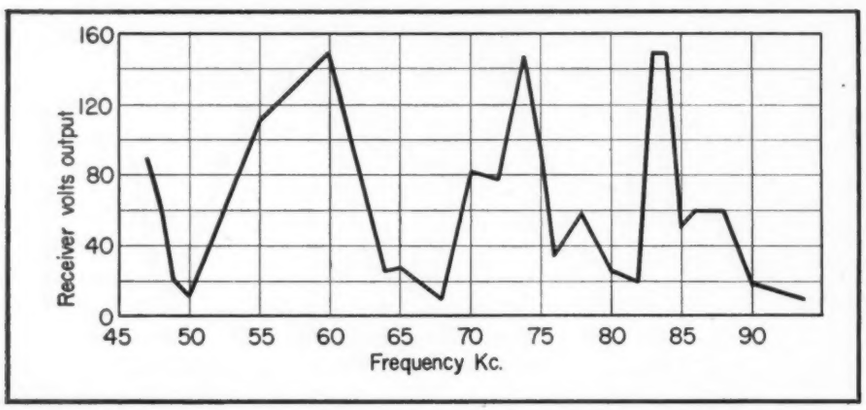


FIG. 3—Carrier-frequency voltage response of a receiver on a transmission network

the desired result we must go further. A series-connected inductance coil develops just enough inductive reactance to exactly cancel the capacitive reactance and resonant condition exists.

Thus, the carrier signal meets practically no opposition and in effect the carrier transmitter and receiver are tied directly to the line conductor, while the power energy is unable to follow that same path.

When carrier energy must be transferred from one line to another or around open switches and transformers, coupling capacitors and tuning inductances are again used. Such an assembly, called a bypass, is especially useful in setting up carrier circuits which can function under all conditions of line operation. The bypass consists of resonant circuits so arranged that the carrier signals find a continuous path around power line devices that would normally represent an open circuit.

Another device essential in maintaining carrier operation under all conditions is the familiar resonant line choke or trap, sometimes jokingly referred to as birdcages. The trap which within itself is a parallel resonant circuit has several thousand ohms impedance at the resonant carrier frequency and has only a small fraction of an ohm at power frequency. Therefore, a trap in a grounding switch lead, for example, allows the line to be grounded for a power clearance while the carrier signals will still be oblivious of ground and thus usable.

The line trap is essentially a component used for guiding and limiting the signal path to the desired destination. In this sense they are installed in tie lines to minimize interference between interconnected systems. Also, traps installed at end of carrier relay zones prevent shorting out blocking signals by faults outside the zone.

Frequency Comparison

Power line carrier in any application is essentially wired radio, in which a low radio frequency is used but one that is still comparatively much higher than the power frequency. This difference of frequency permits easy separation of signals from power energy and its harmonics, by means of tuned or resonant circuits.

While the desired signals normally follow line conductors, some space radiation does take place, although little use has been made of this principle in power systems except for paging and monitoring purposes. A good mobile carrier receiver can pick up strong signals several hundred feet from a high line and also while under distribution conductors. This principle under certain conditions could supplement emergency radio communication.

Carrier Band

Power line carrier usually operates in the band within 50 to 150 kc., although this spread is exceeded at times at either extreme. This particular part of the entire electromagnetic spectrum has no special magic as far as carrier is concerned. It is a frequency high enough to be easily separated from the power energy by tuned circuits, it contains sufficient space for several channels and transmission losses are low enough to make long distance carrier practical. At higher frequencies the losses increase rapidly, partly from more space radiation which can result in serious interference with radio broadcasting stations.

At frequencies much below 50 kc. signal losses in power system components may become excessive, so there are several reasons why the band of 50 to 150 kc. is most desirable for power system carrier.

Wavelength Criteria

It is interesting to compare carrier and power frequency energy from the standpoint of wavelength. This comparison helps to explain the behavior of carrier signals under certain conditions.

We find that the wavelength of one cycle of 60-cycle power is approximately 3,000 miles. This means that in the average normally loaded power network, phase shift as a result of line length need not be considered, because the total distance involved will be only a small fraction of one wavelength. A power line would have to be 3,000 miles long to cause a phase shift of 360 deg.

Now consider the carrier band where wavelengths run from 3.6 miles at 50 kc. to 1.2 miles at 150 kc. If carrier energy is applied to a circuit having parallel paths with one path longer by one-half wavelength or 180 deg., complete cancellation of signal will take

place and the carrier circuit cannot operate. The 180-deg. shift in the relative signal positions over the duplicate paths places successive positive and negative half wave in exact opposition to each other. Maximum cancellation occurs when the difference in effective lengths of the circuits is one-half wavelength or odd multiple of half lengths.

In practice the worst condition is seldom encountered, but often the phase shift cancellation is sufficient to seriously impair the transmission of signals over long distances. The solution for cancellation is to either select if possible, a frequency at which it does not occur, or to install line traps in one of the duplicate paths.

Fig. 2 illustrates a practical example of carrier cancellation in a power network. This simplified diagram is part of a much larger system and has a distance of about 275 miles from points A to C.

Originally a 55-kc. bypass around an autotransformer located at point F was tried in an effort to provide duplicate paths from A to E and C. This proved impractical because of cancellation at E. When the bypass at E was opened cancellation occurred at C. Finally the efficiency of F bypass was purposely lowered to the point where just enough signal is passed through it to allow communication between F and A over the shortest line. Then the only tie from A to E and C is over the 100 kv. system. This carrier phone system is a party line arrangement with several sets on the same frequency.

If this entire power net had been operating at one voltage, no bypass would be necessary, but traps would have been installed to break the loop at one point to eliminate cancellation.

Reflection to be Averted

Reflection of carrier signals is another phenomenon which existing at all frequencies, shows up in the relatively higher frequencies or shorter wave-lengths. Reflection takes place whenever a traveling wave encounters an impedance irregularity, which in a power system will be any branch line, spur, or connected equipment such as a transformer. However all reflection is not highly detrimental. In carrier, reflection in comparatively short spurs gives the most trouble.

When the effective length of a spur approaches one-fourth wavelength or odd multiple, waves reflected from the open end return in the proper phase relation to cancel succeeding waves. This condition resulting in standing waves, causes the feeder end of the spur to appear as a very low impedance to the carrier energy and the carrier channel is short circuited. Again the solution is an installation of line traps in the spur just off the feeder line.

Effective Lengths

Note that the effective length of a line at carrier frequencies is not always the measured length, due to the influence of connected power equipment or other carrier devices. An accurate check on the effect of a spur line at specific frequencies is made possible by the measurement of the spur line characteristic impedance. Low impedance indicates a resonant condition at that particular frequency. By plotting a frequency-versus-impedance graph, the usable frequencies on any line will be shown by high characteristic impedance values on the curve.

Referring again to Fig. 2, the short line between point F and the generating plant happened to be a resonant short circuit of 55 kc. By actual measurement this line had 7 ohms impedance when it should have had 275 ohms. Two 55-kc. traps were installed and the impedance became normal with a very much improved operation on the carrier system resulting.

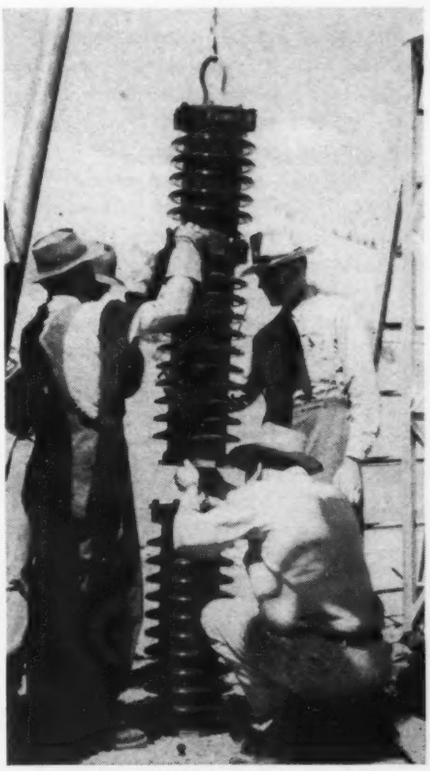


FIG. 4—A high voltage carrier coupling capacitor being assembled

Another case of a resonant short circuit occurred on the tie-line between B and E on 83 kc., which is a telemetering and load control channel. This line of about 3-miles length had to be trapped at B to allow transmission of 83-kc. energy from A to C.

The Ideal Carrier Circuit

A power circuit which is electrically straight, that is, with no taps or loops is the ideal for carrier application. The transmission characteristics will be reasonably uniform over the carrier spectrum.

In contrast to the ideal, Fig. 3 shows a transmission curve of voltage developed in a carrier receiver, plotted against the frequency at which each measurement was taken. The power network in this test was complicated by several loops and numerous taps. The system from a carrier standpoint is far from ideal and many traps would be required to clear it up for carrier, especially if several good channels were necessary.

The ideal carrier circuit can be approached by installing traps at points where lines take off in directions unused by the carrier. The result is a clean uniform point to point carrier path. The frequency selective ability of traps permits crisscrossing of carrier channels through a network while still maintaining an ideal condition.

Irregularities Control

The carrier engineer is mostly concerned with the irregularities of a carrier circuit because the losses in a clean uniform line can be estimated with acceptable accuracy.

Carrier equipment is rated in the allowable loss ratio of transmitted to received energy, expressed in decibels, over which it can efficiently operate. The over-all losses of a carrier channel must not exceed the rating, or improper operation or high noise levels will result. In addition to the unpredictable factors involved, sleet and storm conditions cause increased signal attenuation and higher noise levels which all combine to exceed the equipment rating unless sufficient care is taken in selecting adequate equipment, making thorough pre-installation tests, proper installation and follow-up tests.

This School Wanted the Best in Seeing Conditions

Lighting of hundred-year-old boys' school is modernized—No limitation put on design; only requirement was that results be the best obtainable —Hot- and cold-cathode fluorescent and incandescent sources are all used

ARTHUR A. BRAINERD, Supervisor, Lighting Service Section, Philadelphia (Pa.) Electric Co.

RESULTS WERE the only requirement placed on the lighting layout for Villa Maria Academy at West Chester, Pa. The Sisters of the Immaculate Heart of Mary, who operate this boys' school, were very anxious that the children should have the very best seeing conditions modern science could provide. Thus the installation is of interest, not because of any new development in the art of lighting, but because no limitations were put on the design, the school authorities being willing to try every known method for improving seeing conditions.

The building dates from 1835 and was for a time occupied by the Pennsylvania Military College, then known as the Pennsylvania Military Academy. The year 1945 marked the completion of its first century as a Catholic boys school. The construction of the large U-shaped brick building is typical of its day. All woodwork was dark oak or walnut and many grooves were worn in the floor by thousands of little feet. The windows were equipped with the typical dark brown stained shutters and all possible wall space was taken up with blackboards. The outside of the building was red brick and majestic heavily foliaged trees intercepted most of the daylight. In spite of this inadequate natural lighting, the artificial lighting system gave little real help, since the average illumination was less than 4 foot-candles.

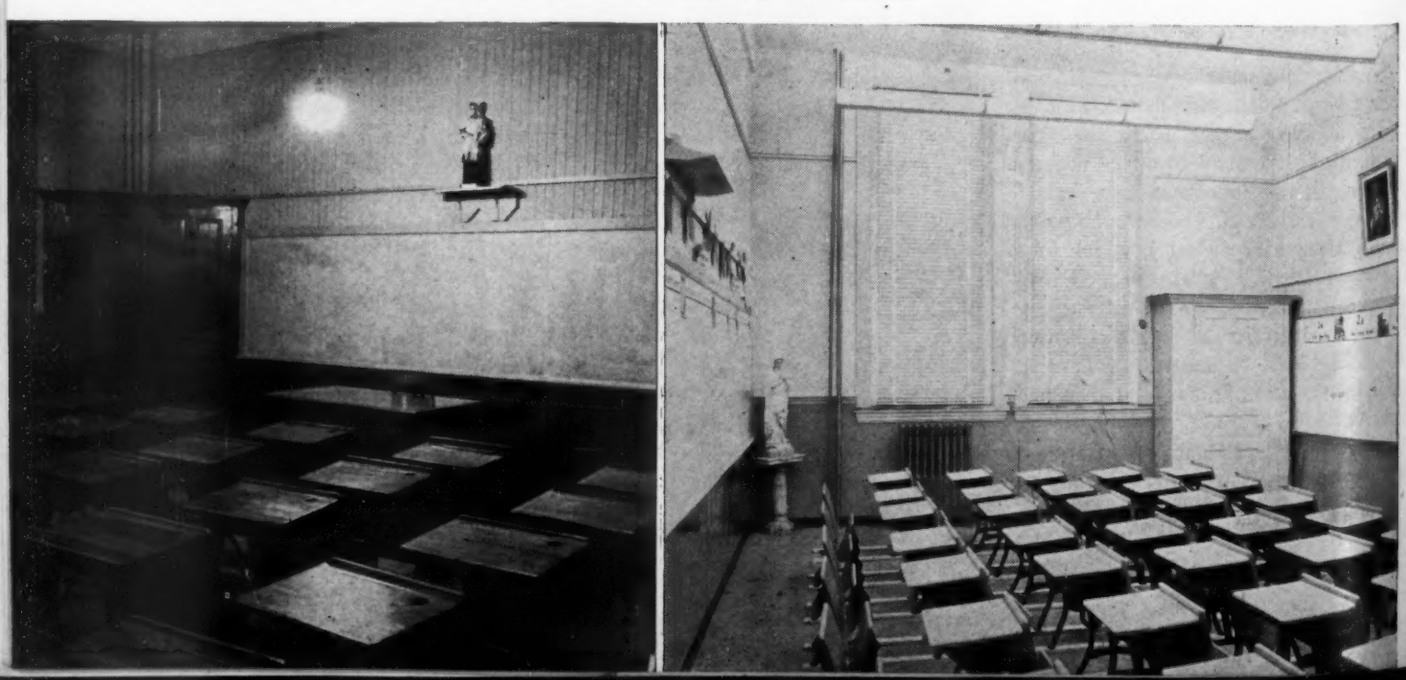
In view of the conditions described above, it was evident that much preparation had to be made before any artificial lighting system could be made to function as it should. The suspended ceilings were finished with a light cream paint, having a reflection factor of 85 percent, developed especially for indirect lighting. The side walls were finished with a daylight green paint having a reflection factor of over 70 percent. The desks were given light cream tops with light buff on the sides. A light buff asphalt tile was used for the floor. The dark, natural wood shutters were replaced by venetian blinds finished in an off-white cream.

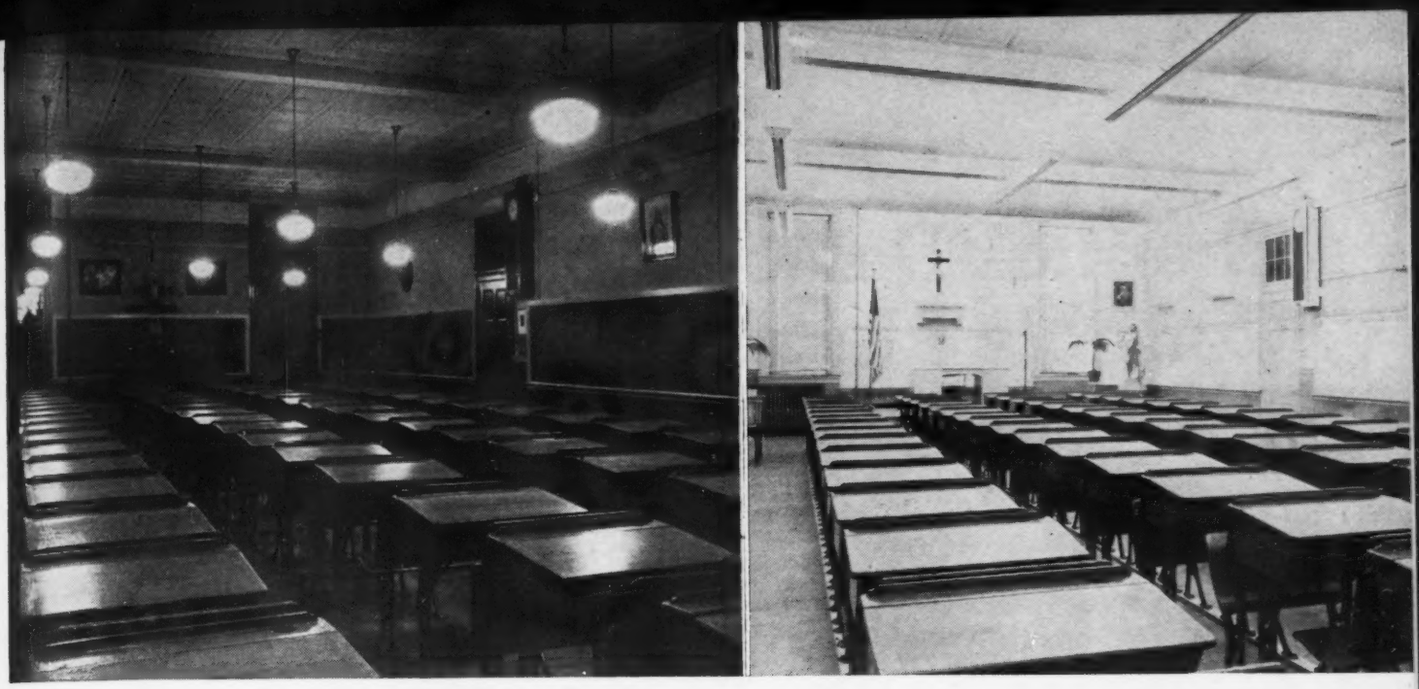
The vast areas of slate blackboard presented an interesting problem. Eventually a method of painting was developed which gave the slate a white matte surface. The problem of a suitable grade of chalk was solved by the use of a special medium blue which was found to erase readily.

As a final touch to improving surrounding seeing conditions, several of the heavily foliaged trees were removed and the outside of the building painted a light cream. This step greatly increased the aid from natural illumination.

When all of these changes had been made, the problem of artificial lighting was greatly simplified. Because of the changes made in the decorations, conditions were now favorable for the use of thoroughly diffuse illumination. Moreover, because of the improved reflection from vertical sur-

AVERAGE ILLUMINATION in the typical class room raised from 4 to 38 foot-candles





IN THE STUDY HALL illumination was increased nearly ten times, from 4.5 to 43 footcandles

faces, there was less need of direct light of any sort on the chalk boards. Accordingly, the classrooms were equipped with continuous lines of 2-lamp luminous indirect fluorescent units on 6-ft. centers. This arrangement gave, initially, 40 footcandles on the horizontal plane and 18 footcandles on the vertical plane of the chalk boards. In the study hall, a similar type of unit equipped with 100-watt lamps in intermittent rows was utilized. Separate germicidal units were installed at the sides of the rooms to reduce the prevalence of airborne bacteria.

Since the lighting installation depends for its efficiency on cleanliness, arrangements were made for removing dust from the venetian blinds and the indirect fixtures by air pressure. Here again redecoration in light hues of high reflection factor greatly improved the effect as well as over-all efficiency.

The lighting of the refectory presented quite a different problem. This area is divided into two rooms by means of sliding doors. One room is 50 ft. by 59 ft. in area, and the other 36 ft. by 59 ft. The original lighting consisted of 100-watt lamps in thin, bell-shaped ground-glass shades, suspended by single drop chains about 8 feet above the floor. Since the ceiling is 16 feet in height, the net result was far from satisfactory. The final solution was a rectangle of cold cathode tubes, four tubes wide, suspended 18 inches below the ceiling and following the line of the tables. This system offered several advantages, such as no low hanging equipment, ability to vary the amount of light without spoiling the light pattern, and functional arrangement following the line of the tables. Since continuous operation was considered more important than efficiency, the long life of the tubes was judged to be of considerable advantage.

One other interesting area is the assembly room where the students and sisters entertain their friends. The beauty and character of this room was marred by the use of commercial type enclosing globes on chain suspensions. This suspended equipment was replaced by indirect incandescent floor portables. Similar treatment has been used in the priest's room. All offices are equipped with luminous indirect incandescent luminaires.

The modernization of the lighting at this school is not in any sense radical. In fact, the maintained lighting in the classrooms of 30 to 40 footcandles will probably be in line with the revised Illuminating Engineering Society School Lighting Code. The systematic use of light colored surfaces of contrasting hues to improve the quality of the lighting is certainly a step ahead of general practice. The results are excellent, and the many who have made the pilgrimage to Villa Maria are enthusiastic over the results.

COLD-CATHODE SOURCE in the refectory supplies 23 footcandles as against 4.5 footcandles before

Thermal Demand Meter Test Controls Phase of Load Current

Instead of using rheostats to control artificial loads supplying thermal demand meter test circuits, Detroit Edison uses adjustable ratio transformers in the primary of loading transformers to control phase angle of test current and thus permit magnitude control

E. J. NORTON and E. D. KANE, The Detroit Edison Co., Detroit, Mich.*

THERMAL DEMAND meters present test problems that are not ordinarily encountered in meter testing practice. Economic considerations rule out field test methods and so servicing this type of meter becomes a shop problem.

Of 19,000 such meters in service on the Detroit system, about 2,500 fall due for test each year under the present schedule. These 2,500 meters are replaced in the field from our stock of tested meters. New contracts, disconnects and damaged meters modify the requirement somewhat but enough meters must be tested to maintain the stock.

The problem, then, is to develop test methods and equipment so this schedule can be met in an efficient and economical manner.

Largest percentage of the total test time is consumed in reaching thermal equilibrium for each test load applied; and the zero point, in the case of watt-demand meters. Gang testing methods improve the efficiency of test operations greatly, resulting in lower unit cost per meter.

Major Design Features

The testing methods and equipment used in our shop were developed with these considerations in mind. While the resulting board design and control arrangement provides convenient and compact form of test apparatus, certain other decided advantages are claimed for the scheme used.

Resort to accurate phase angle control of test current permits magnitude control by suitable means in the loading transformer primary without recourse to control rheostats. The latter add a heating and space problem that is often annoying, particularly in large-capacity installations.

Ease of manipulation results from grouping instruments and controls on a unit panel. The switching arrangement allows finger tip control transfer to any particular group of meters without complicated wiring changes and the load control operates smoothly through its range with minimum effort and confusion on the part of the operator.

Test equipment can, for discussion, be divided into two divisions: The

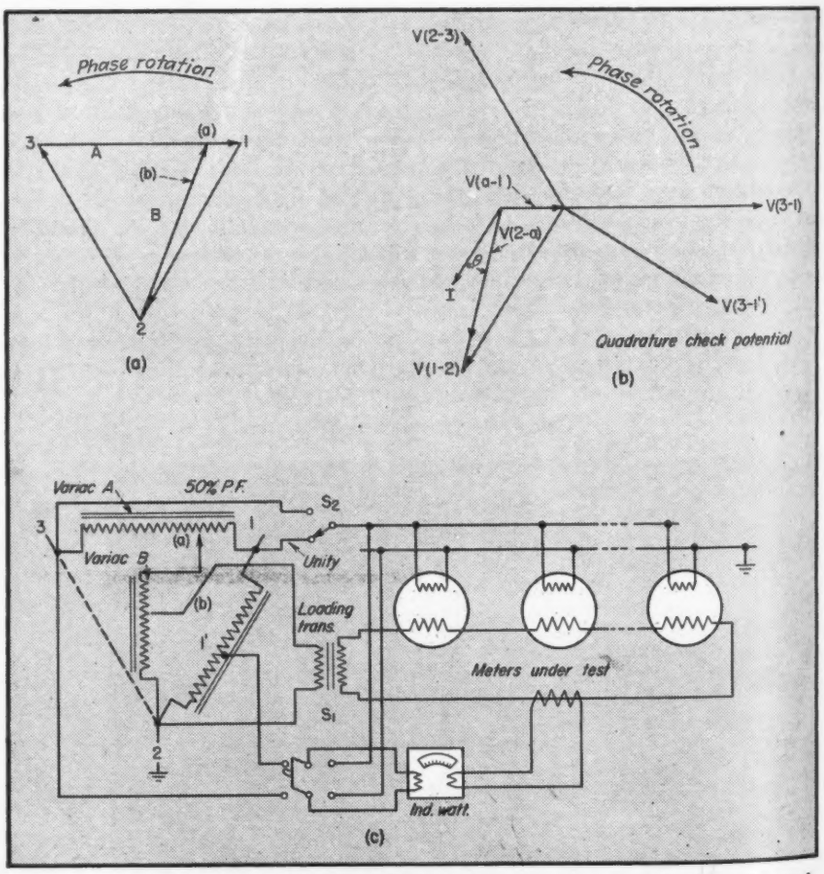


FIG. 1—Vector diagrams and schematic diagram reveal principle of load phase control scheme developed and used in testing thermal demand meters

* Shop Testing and Repair Division, Meter Department.

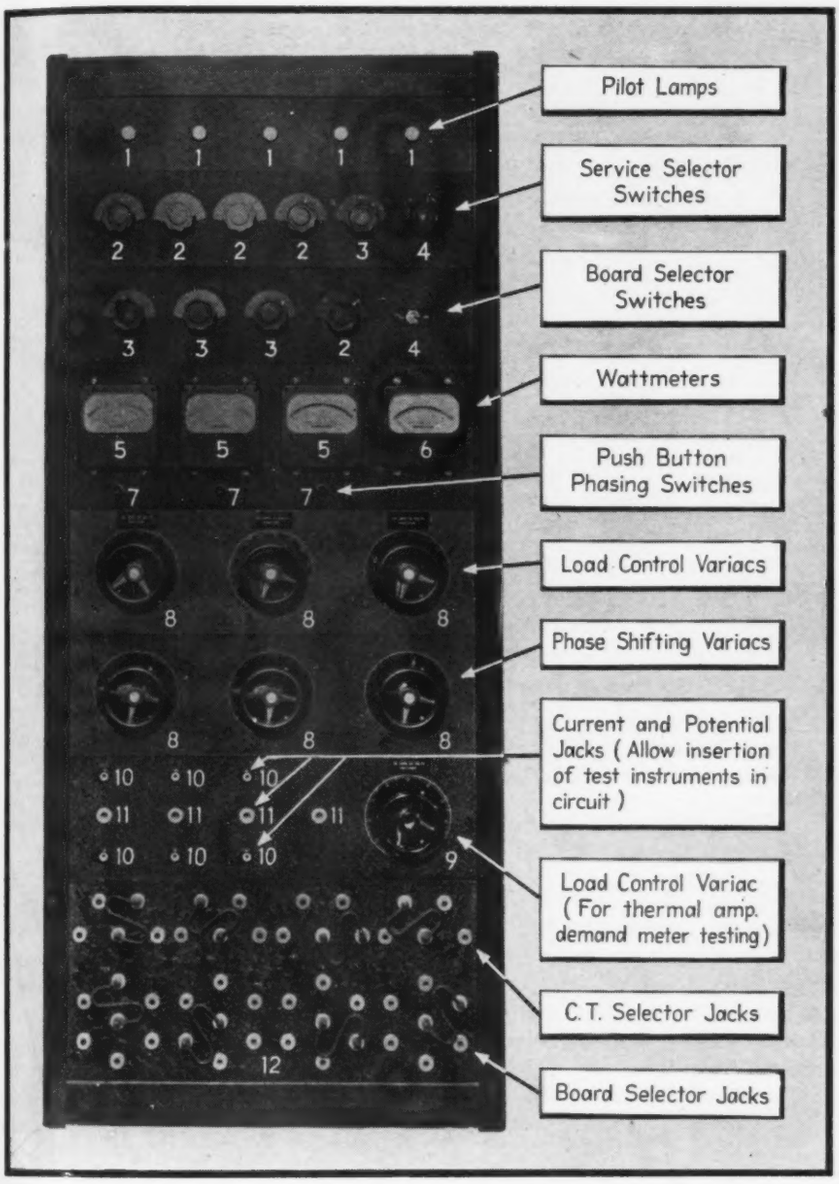

Pilot Lamps
Service Selector Switches
Board Selector Switches
Wattmeters
Push Button Phasing Switches
Load Control Variacs
Phase Shifting Variacs
Current and Potential Jacks (Allow insertion of test instruments in circuit)
Load Control Variac (For thermal amp. demand meter testing)
C.T. Selector Jacks
Board Selector Jacks

FIG. 2—Control panel for thermal demand meter testing. In this panel are centered circuit and potential controls for the six adjacent meter testing panels. Here are three loading circuits for testing thermal watt demand meters and one circuit for testing thermal ampere demand meters. Any control source can be connected to any of the six test panels. Numbers correspond with the listing in Fig. 3

control cabinet and the test tables. The control cabinet contains the load regulating and distribution equipment; the test tables contain controlled load sources and meter mounting fixtures.

Current and potential circuit controls are centered on one control panel. The controls consist of separate potential selector switches for each of six meter test panels and separate groups of current jacks to transfer the distribution control of the current to each test panel. There are three loading circuits for testing thermal watt demand meters and one circuit for testing thermal ampere demand meters. Any one of the control sources can be connected to any one of the six panels on the test boards by the use of multiple-type potential switches and current transfer arrangements. All controls are housed in a steel cabinet 24 by 31 by 76 in. shown in an accompanying illustration. Separate mounting panels are provided for each group of controls.

Load Phase Control

It is common practice to control artificial loads supplying meter test circuits with adjustable rheostats. While this method can be arranged to give the control desired, space requirements and heat dissipation become problems, particularly in the larger load currents.

These problems can be eliminated by feeding the test circuit directly from the secondary of the loading transformer and controlling its primary voltage by means of an adjustable ratio transformer, *provided* phase angle detection and corrective means are used to insure the load current being in proper relations with potential source supplying the potential circuits when wattmeters are being tested.

The circuit arrangement used in our control scheme is a suggested method that has features making it workable over the required ranges. The general arrangement is shown in Fig. 1.

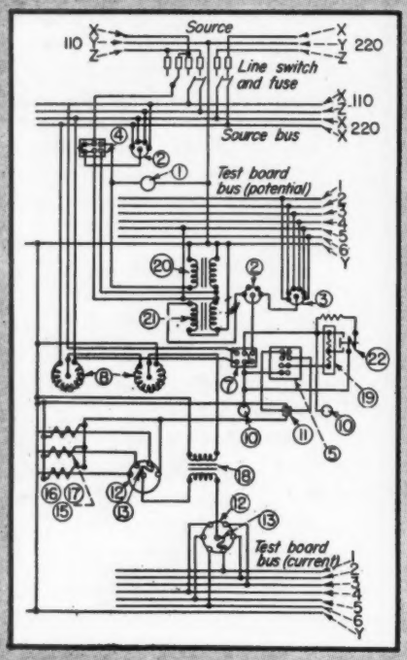
In the phase angle control scheme diagrammed in this illustration (Fig. 1c), the phase-control Variac† (A) is connected across phase 3-1. The load control Variac (B) is connected across phase 2-3, between the point 2 and the moving contact of the phase control Variac (A).

Phase Voltage

It is seen from the vector diagram (Fig. 1b) that the phase voltage V (1-2) is fixed in magnitude while voltage V (a-1) is adjustable. This allows an adjustment in phase angle of the resultant vector V (2-a). This voltage is the source for the leading transformer. It is evident that an adjustment of phase angle causes a change in magnitude of the resulting voltage which affects the value of the load current. This change is negligible in the usual range of adjustment of the phase angle and can be compensated by the load control adjustment which controls the magnitude of voltage V (2-b).

In addition to the apparatus described, a center tap coil is connected across phases 1 and 2 as shown in the schematic diagram. This arrangement allows the selection of a quadrature potential with respect to potential V (1-2) by using the center tap and phase 3 as a source. This quadrature potential is supplied to the potential circuit of the control wattmeter through switch S1 thrown in the proper position. Proper adjustment of phase angle is exhibited by zero indications

† Variable ratio transformer.



DETAIL	DESCRIPTION	LOCATION
1	Pilot lamp—lens color optional	Control Panel
2	Rotary selector switch—1-pole, 4-throw	" "
3	Rotary selector switch—1-pole, 6-throw	" "
4	Toggle switch —2-pole, 2-throw	" "
5	Single-phase wattmeter { 5-amp. 150-volt with special scale	" "
6	Ammeter—5-amp. (with special scale)	" "
7	Push button phasing switch (SPDT)	" "
8 & 9	Variable ratio autotransformer (Variac)	" "
10	Potential terminal	" "
11	Current jack—Make-before-break contacts	" "
12	Load current transfer terminals	" "
13	Transfer link for detail 12	" "
14	Par-metal cabinet 76⅛ x 31¾ x 24 in.	House control unit
15, 16 & 17	Current transformers	Under test bench
18	Load transformer 240/24 volts	Control cabinet
19	External resistor for wattmeter potential	Control panel
20	480/120-volt transformer for 480-volt circuit	Control cabinet
21	480/120-volt instrument transformer	" "
22	Automatic potential range change relay for wattmeter potential circuit control resistor—1-pole, 1-throw	" "

FIG. 3—Typical control circuit, of four centered in control panel. Detail numbers on diagram correspond with those on panel

on the wattmeter. It is suggested that switch S1 be a pushbutton type, the normally closed position connecting the wattmeter to the potential circuit of the meters under test and connection closed on pressing the button, thereby connecting the quadrature potential to the wattmeter.

Instruments

The load control instrument used at three of the four control positions is a wattmeter of the conventional switchboard type modified by having a mirror scale and knife-edge pointer. Scale range is 0.5 kw. Normal values of current and potential are 5 amperes and 120 volts respectively. There are cardinal points at every $\frac{1}{16}$ kw. and the subdivisions have a value of 1/100 kw.

To extend the range of the wattmeter, current transformers are introduced into the current circuit as required. The potential circuit automatically accommodates itself for 120- or 240-volt potential. This is accomplished by connecting a relay across the potential circuit, that is adjusted by a series resistance so that it will not pick up until the potential is in excess of 120 volts. This means that when 240 volts is applied to the potential circuit the relay is actuated and opens its normally closed contacts. If the potential is changed to 120 volts or removed entirely the relay is deenergized and the relay armature drops out again, closing the relay contacts. These contacts are connected to a section of the wattmeter potential circuit resistance and when the relay is deenergized this particular resistor section is short circuited; when energized, the short is removed and the additional resistance is added to the circuit. The automatic action now becomes apparent as cutting in or out of this resistor section by the relay arranges the wattmeter potential circuit for either 120 or 240-volt operation. This scheme has been in use for several years and has given entire satisfaction.

Mirror-Scale Ammeter

The fourth control position uses a conventional switchboard ammeter also equipped with mirror scale and knife-edge pointer. It is scaled in kilowatts the same as the wattmeters to facilitate Type AD demand testing. As in the case of the wattmeters, current transformers extend the range.

Current jacks and potential terminals adjacent to the control position allow the easy introduction of portable sub-standard test instruments into the circuit for calibration of the control instruments or special tests to be made on the demand meters.

In order to eliminate holding an assigned load during a routine test run, a previously tested master demand meter is introduced into the demand meter circuit and used as a reference instrument. In this case the load is set by the control instrument before starting a test run.

Operating Procedure

The load control wattmeter has its potential connected to the potential circuit of the meters under test. The load control Variac (B) is adjusted to give the desired load. The load control wattmeter potential is then transferred by switch S1, to the quadrature potential. Wattmeter indications, if any, are reduced to zero by using the phase control Variac (A). Load control wattmeter potential is returned to the test circuit potential and the load readjusted, if necessary. In general, the load value remains at the value originally set unless a large phase angle adjustment is necessary.

In this control scheme no additional resistance is inserted in the load circuit for control purposes. This ar-

rangement proved to be less costly than the use of potential circuit phase shifters due to the large capacity phase shifter required to supply the meter potential when a large number of demand meters are being tested.

Test Boards

The type A board occupies a floor space 15 ft. 6 in. long by 24 in. wide, the maximum height 67 in. A service shelf is located 30 in. above floor level. Two 1-in. ebonite panels are mounted on the upright structure.

Each panel is provided with mountings to accommodate 24 meters. These mountings consist of a circular bearing surface 1½ in. in diameter with a projecting center stud shaped to fit the top meter support. Below the top mounting fixture is a 4-in. continuous striking plate on which the bottom of the meter rests when hung from the mounting fixture. Individual mounting fixtures for each meter are spaced 7½ in. apart in two rows on each panel. Below each meter position are two dead front potential receptacles from which the individual meter potential is supplied. Current receptacles are provided at each end of the panel and of both polarities, which facilitates making current connections.

The type B board is practically the same in mounting details but different floor space dimensions, being 12 ft. 6 in. by 42 in. It is equivalent to two shortened type A panels mounted back to back. Being shorter the type B boards accommodate 20 meters in two rows per panel as panel A.

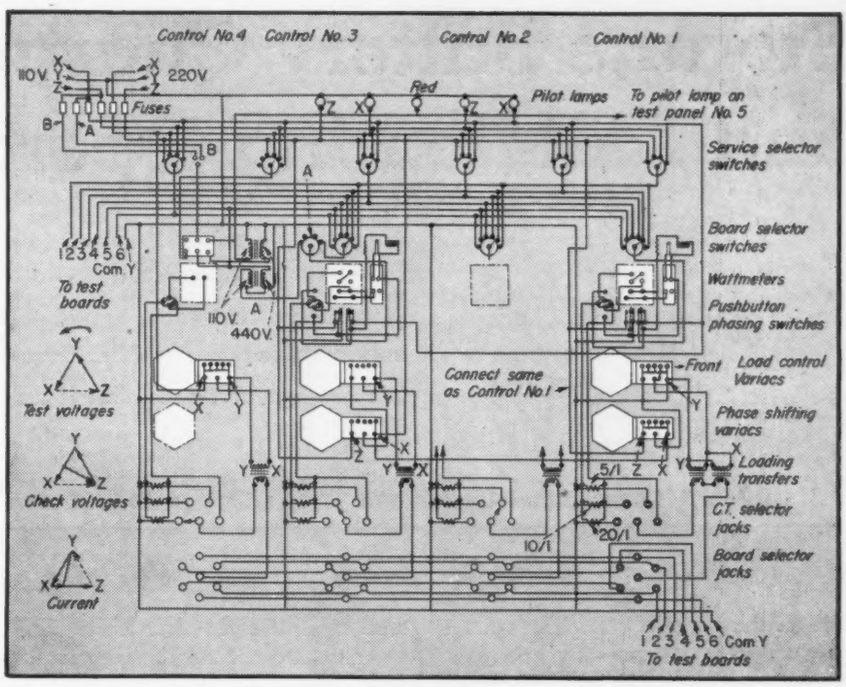


FIG. 4.—Complete panel layout and wiring diagram

Methods of Connection

Due to the various physical sizes of thermal demand meters, it was found that no suitable automatic connector is adaptable at present, so suitable current and potential leads of various lengths are used for connection. Special single and double connectors are employed to connect the potential circuits on thermal demands due to the small sized screws and potential clips used on them.

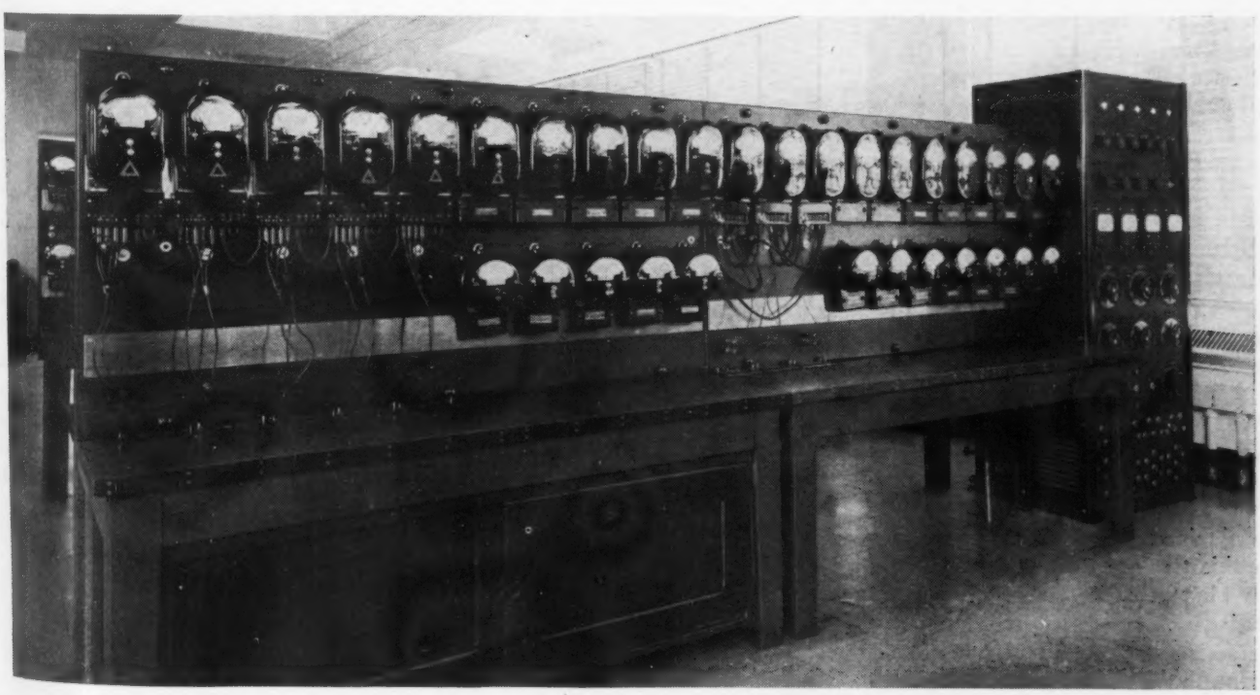


FIG. 5—Thermal demand meter test panel. Central control cabinet is at right. Type B panel shown mounts 20 meters, the longer type of panel mounts 24. Panels are arranged back-to-back and are equivalent to two shortened type A panels

Storage Battery Charging and Full-floating Operation—II

Details of procedure observed in maintaining batteries in fully charged condition—Precautions taken in tests and maintenance for equalization and long life of cells—Human variables reduced to minimum by comprehensive automatic regulation and program

I. F. FREED, Consolidated Gas Electric Light & Power Co. of Baltimore (Md.)*

WITH the correct floating voltage maintained at all times by automatic regulation (see preceding installment in ELECTRICAL WORLD, February 16, 1946, page 92), the next step is to build up a suitable procedure for maintaining the batteries fully charged.

The Consolidated Gas Electric Light & Power Co. of Baltimore has adopted the following procedure. Tests are made to determine: (1.) The full charge characteristics of all cells of a battery when installed new and to select suitable pilot cells for observation, (2.) the self-discharge characteristics of all cells in the battery when first installed, and (3.) the full charge and self-discharge characteristics of all cells in all batteries at 3-month intervals.

Routine checks are made of the floating charges and monthly equalizing charges are given all batteries.

Full-charge Procedure

Briefly stated, the procedure followed is: When a new control battery is installed, it is given its first test during the initial charge. The length of the initial charge and the current rate of the charge are fixed by the recommendations of the manufacturer, and these are continued for the first test until at least four 1-hr. constant voltage readings corrected for temperature are obtained. The readings taken during this test are tabulated in Table I The pilot cells are selected from the readings obtained 15 min. after the charge is started. They consist of cells having high, low and average self-discharge rates in order to give a good representation of the charging requirements of the entire battery. This test determines the voltage and specific gravity at which all plates in each cell of the battery are fully charged. The readings obtained are used for comparison with those obtained on subsequent tests and are recorded on the special form shown in Fig. 1.

State-of-charge Readings

The second test is made to determine the correct floating voltage for the

TABLE I

Readings of Lead-Acid Cells Taken During the Test to Determine Pilot Cells and Full Charge Cell Characteristics

TIME	READINGS TAKEN
Before start of charge	Specific gravity of all cells; temperature of several cells in each tier and row.
15 min. after charge started	Cell voltage, positive and negative cadmium voltage of all cells; temperature of several cells in each tier and row.
During the charge—at 15 to 30-min. intervals	Cell voltage, positive and negative cadmium voltage and temperature of pilot cells.
Just before completion of the charge	Cell voltage, positive and negative cadmium voltage of all cells; temperature of the pilot cells.
15 min. after completion of the charge or after gassing has stopped	Specific gravity and floating voltage of all cells; temperature of the pilot cells.

TABLE II

Readings of Lead-Acid Cells Taken During the Test to Determine the Correct Battery Floating Voltage and the Length of the Equalizing Charge

TIME	READINGS TAKEN
Before start of charge	Floating voltage and specific gravity of all cells; temperature of the pilot cells.
15 min. after charge started	Cell voltage, positive and negative cadmium voltage and specific gravity of all cells; temperature of the pilot cells.
If Charge Must Be Continued:	
At 15-min. intervals till four constant readings are obtained	Cell voltage, positive and negative cadmium voltage and temperature of the pilot cells.
Before battery taken off charge	Cell voltage, positive and negative cadmium voltage of all cells; temperature of the pilot cells.
15 min. after completion of the charge or after gassing has stopped	Specific gravity of all cells; temperature of the pilot cells.

* Assistant to Superintendent, Power Transmission Stations.

FIG. 1—Form for recording cell voltage, cadmium voltage and specific gravity readings of lead-acid cells in storage batteries

(1051)—D-141—88958—2B-16 C. G. E. L. & P. Co. of B. Power Trans. Stas.

STORAGE BATTERY REPORT SHEET

Sta._____ Battery_____

Date Battery Cleaned_____

Doors_____ Windows_____ Ventilators_____

End Cell Switch Openings_____ Parts_____

Electrolyte: Before Filling_____ After Filling_____

Filled_____ A.M. P.M. Date_____ Charge_____ Rate_____

Charge Started_____ A.M. P.M. Finish_____ A.M. P.M. _____ Date

Voltages Taken_____ A.M. P.M. _____ Date. I._____

Gravities Taken_____ A.M. P.M. _____ Date

Gravity Readings Corrected for Temp. Yes No Temp.F°_____

Cell	Volts	Pos. Cad.	Neg. Cad.	Specific Gravity	Cell	Volts	Pos. Cad.	Neg. Cad.	Specific Gravity	Cell	Float. Volts	Cell	Float Volts
1					44					1		44	
2					45					2		45	
3					46					3		46	
41					84					41		84	
42					85					42		85	
43					86					43		86	

Specific Gravity Readings Taken By_____

Remarks on Reverse Side Yes No Operator_____

battery and the ampere-hours required for the equalizing charge. After completion of the initial charge, the battery is allowed to float at the value per cell recommended by the manufacturer. After one month of floating at this voltage, the state of charge of the battery is checked by placing the battery on charge. The readings taken during this charge are shown in Table II. These readings indicate the state of charge of the battery as a result of the floating voltage setting used the previous month. The readings obtained 15 minutes after the start of the charge are compared with the final readings obtained at the end of the initial charge of the battery. If these readings compare favorably, the charge is discontinued; if they do not, the charge is continued until the voltage readings corrected for temperature, taken on the pilot cells, remain constant for four 15-min. intervals, after which the equalizing charge is considered complete.

The ampere-hours required for this equalizing charge determine whether the floating voltage should remain the same or be changed for the next month's trial. If the additional charge is required to bring all plates to the fully charged condition, the next higher floating voltage is tried. If the cells show full charge at the time of the first readings taken during the charge, the next lower floating voltage is tried. The above procedure is repeated monthly for each voltage setting. The correct floating voltage will give within one hour of the start of the charge (at the finishing charging current rate for the battery tested) the values of specific gravity and voltage obtained at the end of the initial charge of the battery. The ampere-hours required to bring all plates to the fully charged condition establish the equalizing charge.

Aging and Defects

The third test is made quarterly to determine the effects of changing operating conditions, battery aging, bat-

FIG. 2—Form for recording daily readings on the pilot cell and electronic regulator

(1051-A)-1B-16 C.G.E.L.& P.CO.OF B. Power Transm. Stas.

REGULATOR AND GRAVITY DAILY REPORT

Sta. _____ Opr. _____ Date _____

Time	Battery Amperes	Generator Amperes	Battery Voltage	Regulator Dial Setting	Regulator Milli-amperes
1 A.M.					
2 "					
11 "					
12 "					
1 P.M.					
2 "					
10 "					
11 "					
12 "					

Pilot Cell No._____

Time	Sp. Gr.	Temp.	Operator
2:00 P.M.			
10:00 P.M.			
6:00 A.M.			

Remarks: _____

tery defects, etc. The readings taken during this test are shown in Table III. The first readings obtained give an indication of the state of charge of the battery as a result of operating conditions and floating for the previous 3-month period and are compared with the same readings taken on the test previous to this. If they compare favorably, the battery is taken off charge and water, if needed, is added to bring the electrolyte to the proper level. The battery is then put back on charge at the finishing charging current rate for the predetermined period of the equalizing charge. During this charge all cells are examined for clues indicating their condition. Color and appearance of plates, plate buckling, plate fracture, separator wear and the amount of sediment in bottom of the cells are noted.

TABLE III

Readings of Lead-Acid Cells Taken During the Quarterly Test to Determine Changes in Cell Characteristics

TIME	READINGS TAKEN
Before start of charge	Floating voltage and specific gravity of all cells; temperature of the pilot cells.
15 min. after charge started	Cell voltage, positive and negative cadmium voltage of all cells; temperature of pilot cells.
Charge is interrupted and water, if needed, is added and battery put back on for the equalizing charge.	
At 15-min. intervals till four constant readings are obtained	Cell voltage, positive and negative cadmium voltage, and temperature of the pilot cells.
Before battery taken off charge	Cell voltage, positive and negative cadmium voltage of all cells; temperature of the pilot cells.
15 min. after completion of the charge or after gassing has stopped.	Specific gravity of all cells; temperature of the pilot cells.

Equalizing Charge

Readings obtained during the equalizing charge, and the ampere-hours required for this charge, are checked against those obtained when the last floating voltage was determined. If these compare favorably, the same floating voltage is retained. If the length of the equalizing charge has increased, an investigation is started to determine the cause. Operations, maintenance work, disturbances, conditions of cells, etc., are checked. If nothing abnormal is found or if the trouble is accounted for, the same floating voltage is used and another equalizing charge test is made one month later. If found normal, no further tests are made until the next quarterly test. If aging has increased the self-discharge of the cells, a new floating voltage for the battery is determined in the same manner as previously described for a newly installed battery.

Monthly equalizing charges are given to all batteries. The performance of the batteries while floating and during the monthly equalizing charges is watched through the medium of routine checks. The readings taken during these routine checks are shown in Table IV. They are recorded on the forms shown in Figs. 1 and 2. The pilot cell used for constant observation is one having average self-discharge characteristics. The readings obtained indicate the daily, weekly and monthly performance of the batteries and the electronic regulators.

All tests and routine checks are performed or supervised by specially trained battery maintenance men. The readings obtained are plotted by these battery men in record books that permit comparison of all test and check readings of each individual cell for the entire life of the battery. The plotted curves of the cell charge voltage, negative cadmium voltage and cell floating voltage of an individual cell in a battery obtained during the initial and quarterly tests are shown in Fig. 3. The plotted curve of the specific gravity readings of an individual cell of a battery over a period of years obtained in the same substation during the tests and routine checks are shown in Fig. 4.

During the process of recording, the readings of each cell are analyzed. All indications of abnormalities, such as low floating, excessive specific gravity drop, excessively high or low charging voltages, excessive changes in cadmium voltage readings, statements of plate discoloration, cracked grids, etc., are investigated. Readings indicating a change in an individual cell or a gen-

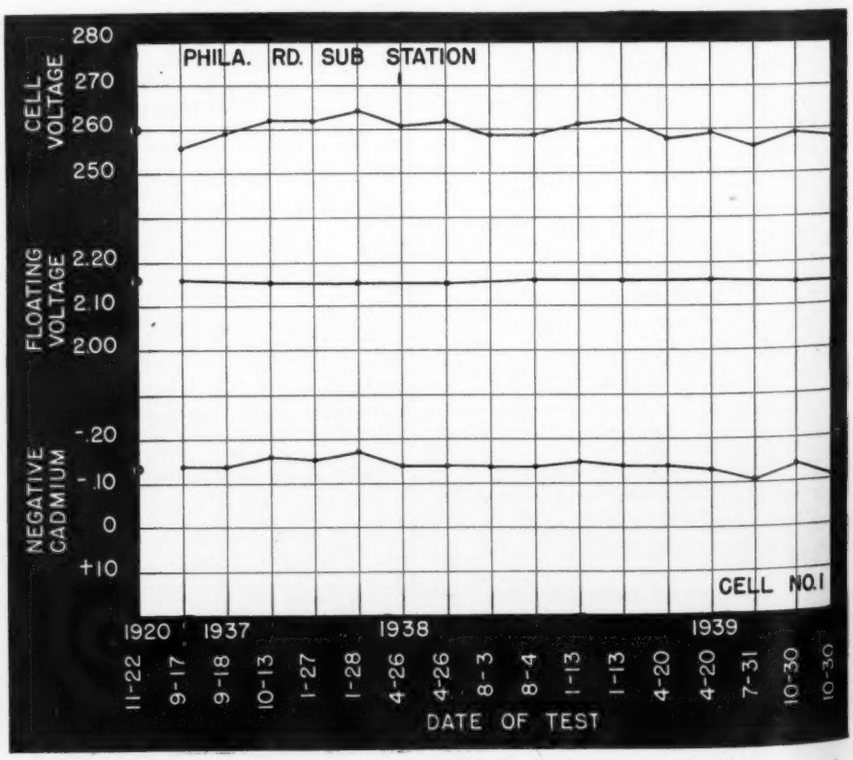


FIG. 3—Typical curves of the cell charge voltage, negative cadmium voltage and floating voltage of a lead-acid cell in a storage battery

TABLE IV

Readings of Lead-Acid Cells Taken During the Routine Checks to Observe Battery Performance

TIME	READINGS TAKEN
In Attended Stations By Operator	
Once every hour	Dial setting and milliampere reading on electronic regulator, battery voltmeter and ammeter reading.
Once each shift—eight hours apart	Specific gravity and temperature of pilot cell.
Once each week	Specific gravity of all cells; temperature of a selected number of cells in each tier and row.
Once monthly, 15 min. after completion of equalizing charge or after the gassing has stopped	Specific gravity of all cells; temperature of a selected number of cells in each tier and row.
In Unattended Stations By Battery Men	
Once every two weeks	Dial setting and milliampere reading on electronic regulator, battery voltmeter and ammeter readings; specific gravity, temperature and floating voltage of pilot cells.
Once each month before start of equalizing charge and before water is added to bring electrolyte to proper level	Specific gravity, temperature and floating voltage of the pilot cells.
During equalizing charge at 15-min. intervals	Cell voltage, positive and negative cadmium voltage and temperature of pilot cells.
15 min. after completion of equalizing charge or after the gassing has stopped	Specific gravity of all cells; temperature of a selected number of cells in each tier and row.

eral condition throughout a battery are investigated in the field. If this is not possible, the cell or a sample cell from the battery is removed from the battery circuit, replaced by a spare cell or jumped out with jumpers and brought to the battery repair shop for checking. If the trouble indicated is obviously a short circuit due to separator failure or lead rundowns, the cell is taken apart, repaired, fully charged and returned to its circuit. If the trouble is not quite so obvious, the cell, in the condition in which it was removed from service, is discharged at the 1-min. rate followed immediately by a discharge at the 8-hr. rate.

Capacities obtained are calculated from the specific gravity, cell voltage, positive and negative cadmium voltages and temperature readings that are plotted for these checks. The cell is then brought to the fully charged state in the same manner as described for a new battery. The first two discharge tests are repeated to determine if the cell takes a normal charge. The cell is then recharged and allowed to float for various periods of time and checked for its self-discharge characteristics in the manner previously described for this test. These tests will indicate whether the chemical reactions of the plates are normal and whether a stable or unstable condition exists. Impurities in the cells may be indicated, in which case a chemical analysis of the electrolyte or examination of the plates themselves may become necessary. The proper remedies are determined for the cell being tested and applied to all cells indicating the same trouble.

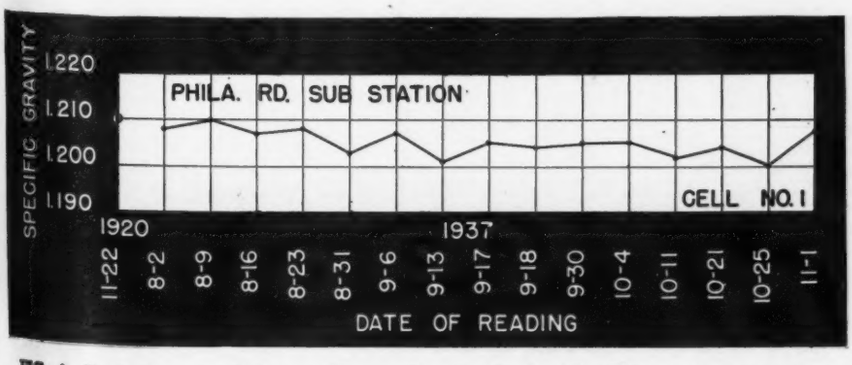
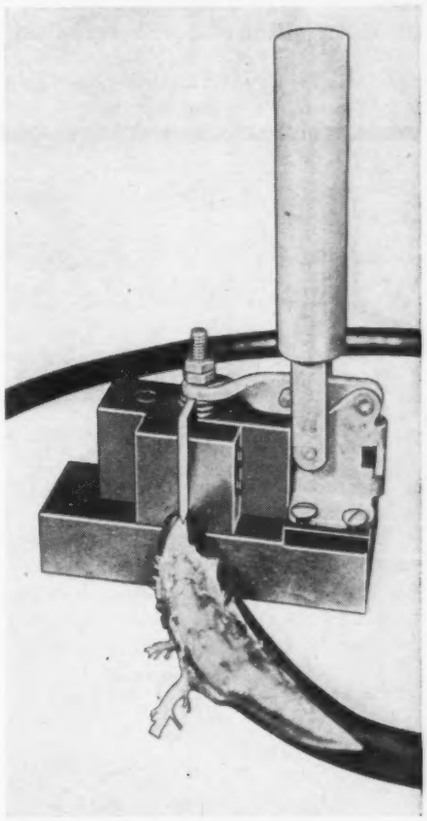


FIG. 4—Typical curve of the specific gravity of a lead-acid cell in a storage battery

Insulation Stripper Has Simple Design

A. H. LANGLOIS
Industrial Electronics Division
Westinghouse Electric Corp., Baltimore, Md.

A tool of recent development is being used to strip insulation from heavy cable. Principal components are a toggle clamp fastened to a block which serves as the base of the tool, and an



TOOL with cable partially stripped

adjustable knife mounted in the upper block which slides up and down on two pins or shafts. The base is counterbored around the shafts to provide seats for the springs which raise the block when the toggle is released.

The knife blade is held in position in the upper block by two set screws; it may be adjusted for any depth of cut. Opposite radiused recesses in the base and upper block provide a track for the cable to run in. After the cable is clamped in position by the toggle and block it is pulled through the tool by hand. The illustration shows the tool with a piece of cable partly stripped.

In operation the tool consistently produces well stripped cables with a minimum amount of time and effort. The simple design makes it easy to build it in any shop.

DIGESTS

Condensations and abstracts of articles in the foreign press, committee reports, unpublished papers before numerous technical societies, research bulletins, standards

The Ideal Watt-Hour Meter

From a paper by G. E. Moore in the "Journal of the Institution of Electrical Engineers" (British), April, 1945.

STABILITY of the electricity meter in all senses during each long term of service is essential. To insure this, care should be lavished on bearings and there should be assurance of permanence of the brake-magnet, which should be aged for two years before going into service. Internal visual inspection should be possible with the cover off or on, and an adaptable box form of terminal is desirable. A ten-year service period is envisaged; on this basis life cost and not first cost is the economic criterion.

The element full-load torque should be 10 gm.cm. and at least 0.7 gm.cm. per gram of rotor weight.

Unusual Barrier in High-Voltage Transformers

From a paper by A. Meyerhand before the Swiss Association of Electrical Association of Electrical Engineers, published in "Brown Boveri Review," March, 1945.

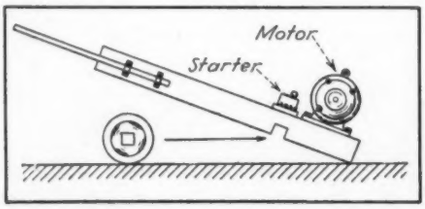
USE OF A splayed flanged cylinder for the barrier between primary and secondary of large high-voltage transformers is said to have the high breakdown strength of bakelized paper and form a more compact and economical structure than the molded flanged cylinders previously employed. Insulating paper as wide as the length of the barrier and flanges is wrapped on a thin bakelized cylinder which forms the support. The paper is scored longitudinally at the ends, and after the assembled cylinder is placed between primary and secondary windings the scored paper is splayed out at right angles to the axis to form a flange. Insulating spacer rings are inserted at regular intervals so that a solid flange is built up at each end of the winding. Cuts through the paper are staggered so that no breaks occur in the insulation.

It is stated that with this construction the distance between high-voltage and low-voltage coils can be reduced to half, even though the breakdown strength of the insulation is increased materially. Reduction in weight of oil required (5 percent) despite doubling of capacity, lower cost of insulating material and smaller dimensions of the tank are considerable, but are less important than the effect of the reduction of the leakage field channel.

Electric Drive For Farm Machinery

From a paper by C. A. Cameron Brown in the "Journal of the Institution of Electrical Engineers" (British), April, 1945.

FEED GRINDING with the ordinary hammer mill demands 10 to 20 hp. for short periods, making it an undesirable rural load. The Electrical Research Association, cooperating with various agricultural colleges, has developed an automatically controlled hammer mill capable of handling the requirements of any farm. It is driven by a 3-hp. motor.



HEAVY FARM motors are easily moved with this mounting arrangement

Grain drying is handled by motor-driven equipment, a layer of grain being passed through a stream of heated air and then through a stream of cold air. Although fuel heating is the rule, one installation with electric heat is in use and others are projected.

Most motors are permanently mounted, but some need has been found for a portable drive for heavy equipment used occasionally. With the device illustrated the motor can be moved readily from place to place. There also is use for a small portable motor which can be adapted to special light jobs.

Since single-phase distribution lines are fairly common in rural England, makers of farm machinery have been forced to produce equipment fitted with single-phase motors as well as with polyphase motors.

Equalizing Mine Hoist Loads

From an article by G. Barnard in "Electrical Review," London, November 23, 1945.

SEVERAL METHODS for providing quick acceleration of mine hoists without imposing undue peaks on the power supply are available. The best known is the Ward Leonard (Ilgner) motor-generator flywheel set, in which the driving motor, usually of the induction type, is allowed to slow down when a load is thrown on the d.c. generator, and energy is released by the flywheel to the electric circuit. The speed returns to normal as the cycle proceeds and the acceleration is completed.

At one colliery the power factor of the supply was improved considerably by using an over-excited synchronous motor to drive the set. The reduction in speed of the flywheel and generator was accomplished by interposing a hydraulic coupling between the two elements. The coupling consists of an impeller rigidly fixed on the motor shaft and a runner attached to the shaft carrying the flywheel and generator. When the coupling is full of oil the generator runs on full load with a slip of 2 to 3 percent. If the coupling is empty the generator stops. The supply of oil is regulated through a valve controlled by a torque

motor in the supply circuit which increases the slip as the load is thrown on the generator.

Another flywheel set, the Stubbs-Perry, has a d.c. generator driven by a high-speed steam turbine through a 6 to 1 reducing gear. The speed of the turbine decreases sharply with load.

Where system capacity is ample the flywheel may be dispensed with, a larger driving motor being used. Operating efficiency is improved through saving windage losses in the flywheel, which amount to more than 2 hp. per ton. Losses in the hydraulic coupling vary with the slip and are comparable with the loss in rotor resistance used in Ward Leonard Control. In all these sets a flywheel speed variation of 10 to 18 percent is used, depending on requirements.

Electric Heating Methods Compared

From a paper by L. J. C. Connell, O. W. Humphreys and J. L. Rycroft in the "Journal of the Institution of Electrical Engineers" (British), October, 1945.

RADIANT and high-frequency methods offer a very real opportunity for contact and convection heating.

Given really good contact, rates of transfer are practicable up to 10 kw. per sq. ft. (34,000 B.t.u. per hr. per sq. ft.), using lamps of the present type mounted in flat reflector banks. Higher intensities of heat require suitably mounted exposed resistor elements of the type commonly used in electric furnaces, which give intensities at least ten times as great. For certain purposes it is possible to use inputs of eddy-current heating as high as 10 kw. per sq. in. (5,000,000 B.t.u. per hr. per sq. ft.). Higher frequencies must be used for non-magnetic metals than magnetic materials in order to secure the same power input per unit area.

In many processes in which slow heating and a low maximum temperature have been accepted, particularly those in which a chemical change takes place, there is no fundamental reason why a higher temperature and shorter processing time should not be adopted. For instance, in drying certain paint films, heating for 3 min. at a maximum of 400 deg. F. gives results identical with those from 45 min. of heating at 250 deg. Similarly the hardening time of certain of the synthetic resin adhesives may be reduced by 50 percent for each 20 deg. F. increment of temperature.

Moisture removal can be carried out more cheaply by mechanical methods without heat up to a certain point. Electric heating has proved advantageous for drying synthetic sponge; 70 hours are needed in a convection oven, but with dielectric heating only a few minutes are needed.

400-Cycle Fluorescent Lighting for Buses

From an article in "Electrical Review," London, December 14, 1945.

LIGHTING of buses with 18-in. fluorescent tubes taking 15 watts is being carried out on buses having 12-volt or 24-volt storage batteries through the use of a motor-generator set delivering alternating current at 110 volts and 400 cycles. The thermal starting switch is replaced by a choke in series with the lamp and a condenser across its terminals, arranged to be in resonance. The voltage across the condenser is sufficient to start the discharge, and the resonance of the circuit ceases when the discharge takes place. The efficiency of the lamp circuit is 75 percent, which is reduced to 50 percent over-all by the motor-generator, which is of a conventional type running at 3,000 rpm. The weight is about 100 lb. for a double-deck bus equipment, while the choke and condenser weigh about 2 lb. for each lamp.

Experiments are being conducted with a vibrator to replace the motor-generator, the alternating current being stepped up to 110 volts through a transformer. In this system a starting switch must be used, as resonance is not effective.

Precision Instrument for A.C. Measurements

From a paper by G. F. Shotter and H. D. Hawkes before the Institution of Electrical Engineers (British).

DEMAND for more accurate commercial a.c. power and voltage measuring instruments led to the development of the a.c.-d.c. comparator, which has the accuracy of d.c. testing instruments using a potentiometer. The new instrument, which was designed as a sub-standard, uses a null method based on the balancing of two torques. It consists of two elements, (a) the measuring system, an ironless moving-coil dynamometer and (b) the control system, a permanent-magnet moving-coil instrument. The dynamometer is mounted above the permanent-magnet instrument, the two moving coils rigidly coupled and the whole moving system supported by a double taut suspension. Both

CHARACTERISTICS OF THE VARIOUS HEATING METHODS

	Conduction	Convection	Radiation	Dielectric heating	Eddy-current heating
Limitations on shape, material, etc., of articles	Article must have surfaces of such a shape as to permit good contact with the heater	.....	Good reflectors (e.g. polished metals) or materials transparent to radiation cannot be heated efficiently	Suitable for electrical insulators, provided they have not too low a loss factor at high frequencies. In general, the article should be of uniform thickness and reasonably homogeneous	Suitable for electrical conductors. Magnetic materials may be heated more readily than non-magnetic
Necessity for contact during heating	Necessary	Unnecessary	Unnecessary	Usually desirable, but not always necessary	Unnecessary
Mechanism of heating	Conduction from surfaces	Conduction from surfaces	Usually by conduction from surfaces, though heat is sometimes generated within the article as well	Provided the material is homogeneous and of uniform thickness, heat is generated uniformly throughout	Heat is generated near the surface. The depth in which it is generated decreases with increase of frequency
Rate of heating	Dependent on thermal conductivity of article and on intimacy of contact with source. Rates up to 34,000 B.Th.U./h/ft.^{2} are typical for metals	Natural convection, approx. 350 B.Th.U./h/ft.^{2} for a temp. difference of 300 deg. F. between air and article. Corresponding figure for forced convection (air velocity, 20 ft./sec.), 1,630 B.Th.U./h/ft.^{2}. Rate falls off as temp. difference decreases	Dependent on absorptive power of article. Maximum for lamp equipment, about 2,000 B.Th.U./h./ft.^{2} of surface; and for exposed resistor equipment, 25,000 B.Th.U./h./ft.^{2} Rate falls as temp. of article rises	Rates of 10,000 B.Th.U./h/ft.^{2} and over are used in certain applications	Rates of 5,000,000 B.Th.U./h/ft.^{2} and over are used in certain applications

the measuring and control windings are designed for small currents, multipliers or transformers being used for connection to the external circuits. The instrument is compact, the outside diameter of the dynamometer field coils being 1⅞ in. The two elements are screened against magnetic and electrostatic interaction and the whole apparatus is screened against external magnetic fields.

Readings are made with a beam from a self-contained spotlight, the distance from the mirror to the scale being 5 in. Sensitivity of measurement is comparable to that of a deflecting instrument with a scale length of approximately 18 ft. On power measurements a change of 1 part in 10,000 in nominal volt-amperes at unity power factor is readily detected, and for voltage a similar change can be seen for values down to half the nominal voltage.

Calibration is effected by passing direct current through both elements with the moving coils opposed, the standardizing current being measured on a potentiometer. Since the dynamometer torque varies with the square of the current while the control torque varies directly with the current the balance is critical and well defined.

Many of the errors inherent in instruments are avoided due to the null method. Out of 16 sources of error common in dynamometer wattmeters, eleven, including the most annoying, are not inherent, and control of the remainder is a matter of compensation in design.

Initial calibration of precision wattmeters, which is one specific use of the instrument, is simplified since only one potentiometer is used. It also has been used successfully for checking rotary sub-standards and domestic meters.

Extraneous Conditions Affect Temperature Rise

From an article by J. Prevost in "Brown Boveri Review," December, 1944.

LOW TEST temperatures for electrical equipment are no guarantee of cool running in service. Clogging of open cooling systems may have a far more deleterious effect than an ambient temperature 10 to 15 deg. too high in a closed cooling system. The loss of ventilation is the more serious as it takes place gradually and may pass unnoticed.

In the air circulating system, heating of the air by the pressure fan of a large unit amounted to about one-fourth the specified temperature rise of 25 deg., even before the air came in contact with the parts to be cooled. For that reason fans of the suction type are preferable.

Thermal conductivity from coils to iron is far from proportional to the thickness of insulation. The film of air between slot and coil, even when well packed, has a considerable effect, and with low contact pressure the transition resistance is erratic. On test the temperature gradient of a specimen 1 mm. thick fell to half when the pressure was increased from 0 to 20 kg. per sq. cm. (284 psi.), and remained at the low value when the pressure was carefully reduced to zero. At the slightest shock, however, it returned to the higher value. Measurements of transition resistance at the contact surfaces differed as much as 50 percent.

Efficiency of the machine itself has a great influence on the temperature rise. Since relatively little change in characteristics of electrical machinery has occurred in recent years, while insulating materials have improved, ratings may be increased by rewinding, using new thinner insulations and filling the space gained with copper. With few exceptions the cost is more than repaid.

Simple Earth Leakage Protection

From an article by H. Stalder in "Brown Boveri Review," December, 1944.

WHEN A FAULT OCCURS in an alternator armature, a voltage at system frequency appears between neutral and earth, so that a relay responding to it can be made to cut out the unit and prevent a more serious short circuit. In a generator-transformer unit, a ground on the transformer secondary will act through the windings to produce a voltage whose value is determined largely by the transformer capacity and the secondary voltage. In order to eliminate the effect of this voltage, a resistance of proper value placed in parallel with the primary of the relay transformer in the neutral wire will prevent the relay from responding, and will obviate special means to keep the third harmonic in the phase voltage from tripping it.

With a fault on the generator side of the transformer, the ground current is determined largely by the value of this shunt resistance, since the charging current of the unit always is small. The higher the secondary voltage and the more sensitive the earth leakage relay, the smaller must be the resistance. Currents met in practice usually lie between a few tenths of an ampere and several amperes.

This simple arrangement is said to protect between 90 and 95 percent of the windings. The unprotected portion is nearest the neutral where the voltage stress in service approximates zero, and danger could exist only from voltage surges.

Electromagnetic Pressure Recorder

From an article by H. H. Baxter in the "Electrician," London, December 21, 1945.

MEASUREMENT of transient pressures set up in the operation of switch and fuse gear is facilitated by an electromagnetic pressure recorder devised by the Electrical Research Association. The device resembles in design a telephone receiver. A mild steel cylindrical shell contains a bobbin, with a core of soft iron wires, which is wound with two coils, a primary and a secondary. A tempered steel diaphragm 0.0065 in. thick and ½ in. in diameter is mounted at the end of the cylinder at a distance of 0.12 to 0.15 in. from the end of the wire core. The diaphragm is held in place by a brass cap which is threaded at the opposite end so that it may be screwed into a hole in the side of a cartridge fuse. The entire unit is approximately 1¼ in. long and the cylinder diameter is ½ in.

A constant alternating voltage at 1,000 cycles is impressed on the primary coil, while the secondary coil is connected to an oscillograph. Any change in the pressure on the diaphragm causes a corresponding change in the secondary voltage, which is recorded by the oscillograph. Static or dynamic pressures of the order of 500 psi. can be measured with accuracy. With the Duddell or cathode ray oscillograph the fundamental wave can be suppressed so that only the peaks due to changes in pressure will appear on the record.

Telephone Interference from Power Lines

From a paper by P. B. Frost and E. F. H. Gould before the Institution of Electrical Engineers (British), November 1, 1945.

FIELD TESTS of audio-frequency voltages indicate that in many instances the mutual inductance between two lines with ground return can be calculated with sufficient accuracy for practical purposes. The value of 5 millivolts for the psophometric (a British name for an instrument comparable to our TIF meter) emf. in an open wire line, which corre-

sponds to about 1 millivolt at the telephone receiver, must be considered too high. Noise induced on circuits paralleling an 11-kv. network is less with an arc-suppressor coil than wth solid grounding, and under fault conditions the noise voltage is greatly increased.

Safety of personnel and apparatus may be secured by grounding the telephone line at intervals while the power fault current persists. The stringent requirements are met in part by 3-electrode gas-discharge tubes, and in default of a better solution many of these have been used. The breakdown voltage is not uniform, and after long inaction operation is delayed by the absence of free electrons. The tubes do not appear to function with the higher frequency transients arising with Petersen coil operation. Gas-discharge tubes generally have to be installed at points remote from maintenance centers, and functional tests are not economically possible.

A relay has been tested as a substitute for the gas-discharge tube and would act in the same manner. It is in the experimental stage. Noise elimination filters have been studied for use in extreme cases.

Mineral Used for Cable Insulation

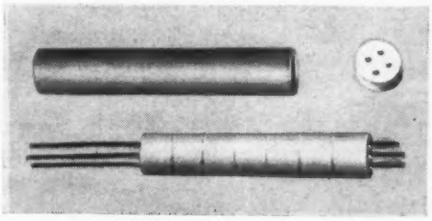
From a paper by F. W. Tomlinson and H. M. Wright before Institution of Electrical Engineers (British).

POWDERED MINERAL INSULATION has been used for some time in heating elements, but only recently has it been adapted to conductors in ordinary service. The most recent British development is a mineral-insulated, copper-covered cable.

When a mineral dielectric in powdered form compressed within a tubular sheath is subjected to deformation or bending, it behaves much as a homogeneous plastic. Magnesium oxide is used by several manufacturers, as it is a good insulator and a comparatively good heat conductor. Other materials, including siluminite, aluminum oxide, calcium oxide, boric oxide, beryllium oxide, powdered glass, kaolin and zircon have been tried.

Magnesium oxide's dielectric strength is increased by compression. At 3 tons per sq.in. it has approximately six times the breakdown strength of air, or 760 kv. per in. at room temperature, dropping slowly to 635 kv. per in. at 300 deg. C. Its specific resistance, which is practically infinity at room temperature, varies inversely with the temperature, being for a certain cable about 150 megohms at 500 deg. C. and 1 megohm at 900 deg. Magnesia is hygroscopic, combining with water to form magnesium hydroxide and also absorbing uncombined water. The hydroxide does little harm, but free moisture will permit an appreciable leakage current to flow.

Several methods of manufacturing the cables have been proposed, but the only practical one which is used in England is to preform the magnesia into short cylinders with holes left for receiving the wires, and with an outside diameter small enough to go easily into the copper sheath. The magnesia cylinders are heated in a furnace to remove all moisture, then removed in groups and pushed into the sheath while hot. The holes are kept in register and the conductors are pushed through them. The assembly is



COPPER TUBE and conductors, rods and magnesia blocks assembly before drawing to reduce cross-section

then drawn through dies which reduce the cross-section, return the magnesia to powder, and exert pressure on the interior of the sheath. The cable is annealed by passing current through the wires. Lengths produced vary from 200 ft. for a single 0.2-in. conductor cable to 750 ft. for a cable with four 0.0015-in. wires.

In comparison with lead-covered or vulcanized rubber-covered cables, the mineral-insulated cables weigh an average of 57 percent less over a range of sizes and their bulk is 50 percent less.

In order to prevent the entrance of moisture at the joints, the recommended connection is through glands sealed with bituminous compound. A high-temperature seal also can be made for using resistance cable in heating elements.

Since the cable is fireproof, permanent, and sufficiently flexible to permit a certain amount of bending, it is suitable for wiring where conditions are severe, or where there is a fire hazard or sustained heat, as on shipboard and in many industrial plants. The safe carrying capacity is from 33 percent to 100 percent higher than the rating of vulcanized-rubber or lead-covered cable. Copper is more resistant to corrosion than most other materials used for cable sheaths, but where it is unsuitable other metals such as aluminum or stainless steel may be substituted, or the sheath may be protected by paint. The copper sheathed cable may be buried in a normal soil, precautions being necessary only where it is acid or has a high sulphur content.

Calculating Short Circuits

From an article by T. A. Leonard in "Electrical Review," London, November 23, 1945.

CALCULATIONS of possible kva. through a fault in a supply network usually are made by determining the equivalent percent reactance of each generator, transformer or other element, and from their sum the total percent reactance to the assumed location of the fault. In many instances where a number of parallel sources of supply are involved a quicker method is first to determine the short-circuit kva. for each power source and then add the figures.

As an example consider three generators of (a) 70,000 kva., (b) 60,000 kva., and (c) 75,000 kva. with respective reactances of 18 percent, 20 percent, and 15 percent.

On a basis of 10,000 kva., the equivalent percent reactances of the generators are as follows:

(a) $18 \times 10{,}000/70{,}000 = 2.57$
(b) $20 \times 10{,}000/60{,}000 = 3.33$
(c) $15 \times 10{,}000/75{,}000 = 2.$

Percent reactance at a fault F is:

$$\frac{2.57 \times 3.33 \times 2}{(2.57 \times 3.33 + 2.57 \times 2 + 3.33 \times 2)} = 0.84.$$

The short-circuit kva. at F then is:

$10{,}000 \times 100/0.84 = 1{,}190{,}000$ kva.

By the proposed alternate method the short-circuit kva. is $70{,}000 \times 100/18 + 60{,}000 \times 100/20 + 75{,}000 \times 100/15 = 390{,}000 + 300{,}000 + 500{,}000 = 1{,}190{,}000$ kva.

For more complicated circuits where there are both series and parallel reactances, a short-circuit kva. is calculated for each unit on the assumption that the transformer or line is fed by a power source of zero impedance. When units are in parallel the kva. figures are added; when in series the reciprocals of the separate kva. are added.

If there is objection to the use of the reciprocal law for the final calculation of the series kva., then a combination method may be used, first calculating the separate short-circuit kva. figures for each piece of apparatus and then for each parallel group, finally adding the separate figures. The short-circuit values thus obtained for each parallel group may be converted to percent reactances on a common kva. basis. Then the procedure can be continued by the standard method, adding percent reactances of the groups in series and converting the total percent reactance thus obtained to total short-circuit kva.

Editorials

S. B. WILLIAMS, *Editor*

A Realistic Attitude Toward Atomic Energy

FOR THE FIRST TIME in its more than sixty years of existence the Association of Edison Illuminating Companies appeared before a legislative or administrative body recently when it made a statement at the hearings of the Senate committee on atomic energy. That is how seriously the executives of the operating companies serving a majority of the light and power customers regard the possibilities of atomic energy in electricity production and their responsibility to help in its development.

That the association would ever release its statement to the press is in itself equally significant, for it has consistently refrained from seeking or permitting publicity for its activities. Where permission has been given to use the results of its investigations it has been with the understanding they were not to be attributed to the Association. Not so in the case of its statement on atomic energy. Why? Simply because the leaders of the electric utilities want the people of this country to know that they are taking a realistic attitude toward this possible new source of energy. They do not pooh-pooh it as the product of crack-pot dreaming but state their willingness not only to recognize that it may have possibilities but to do everything they can to find out as soon as possible what the possibilities are.

It is clear from reading the statement that the utility industry is soberly conscious of the fact that atomic energy is not just something new, but may be so far-reaching in its possibilities as to have a marked influence on the economy not only of the industry, but the nation as well. Thus in making its appraisal the AEIC committee was instructed not to approach it with any predetermination arising from any conception of any industry policy "other than the exploration of the possibilities of better service." In fact that statement left the impression that the industry had pledged all of its resources to aggressive prosecution of all favorable possibilities for the use of atomic energy in power production.

In other words all that this industry asks is the opportunity to make as thorough an investigation as possible with the resources at its command in order to bring to the consuming public at the earliest possible moment any advantages atomic energy may have in power production.

Nowhere in the statement did the Association promise any startling results indicating, in fact, that there were no great economies foreseen at this time, but should production savings result these would be passed on to consumers under the supervision of regulatory authorities "on the local level." In this way does the industry convey its belief that if the development of atomic energy is to be prosecuted for full public benefit it must be kept out of politics.

Control of the processing of atomic materials, it freely admits, must rest in some such commission as is proposed under the bill which the Senate is considering because "the possibilities of misuse under any other scheme of production are too ghastly to be contemplated."

Those who read the statement in this issue, will, we are sure, be convinced as we were of the utter sincerity of the industry in its declaration of desire to do everything within its power to see that the nation gets as soon as possible whatever benefits that may be had from the use of atomic energy in electrical production. It is an unselfish declaration. It is industrial statesmanship at its highest level.

Change in Administration's Wage-Price Formula Called For

COLLECTIVE BARGAINING is defined as a process in which representatives of employees sit down with representatives of management in an attempt to reach agreement on "hours, wages, and other conditions of employment". Under normal collective bargaining conditions, there is no obligation to reach an agreement, and failing in agreement, the union may strike to enforce its demands and the company may lock out to enforce its demands.

The current strikes in the electrical manufacturing industry illustrate what happens to collective bargaining when the power of government is used to aid one party to the bargaining table at the expense of the other. While firmly limiting the freedom of action of the companies through failure to grant price relief, officials of the government have repeatedly encouraged the unions to expect that wage increases much greater than ever granted heretofore, could and would be paid. Through the medium of unofficial "fact finding" commissions, the government in effect demanded very high wage increases in certain industries, and even without the questionable aid of a "fact finding" commission, the President of the United States named a substantial wage increase for the steel industry. The Valentine's Day wage price formula adds more to the confusion as far as industry is concerned, but clearly encourages unions to expect wage increases throughout the country comparable with those already established by government fiat. The policy, however, still

leaves the question of price relief at the discretion of government administrators who have shown little sympathy for industry's problem. No assurance of immediate price relief is provided even though substantial wage increases bring immediate increase in costs. Supposedly, the formula depends on the union striking in order to force a "bulge" for each important case, as was the situation in the steel case.

During at least 30 days of the steel strike, the company was not bargaining with the union, because there was nothing to bargain about. Instead the negotiations were conducted between the company and the government. When the government granted substantial price relief, thereby admitting that substantial wage increases could not be granted without comparable price increases, the steel strike was ended.

It is indeed unfortunate that the same situation is looming as a major cause of the stalemate in the strikes in the electrical manufacturing industry. A change in the wage-price formula or its administration is clearly called for. Certainly, when a company is called upon by high government officials to make extraordinarily large wage increases, it should be given assurances ahead of time that reasonable price increases will be granted. Unless this is done, many more strikes may be expected.

War Born Barebones Design Gaining Peace-Time Converts

ONE OF THE unmeasured gains from the restrictions applied during the war was the pressure to eliminate frills and unjustifiable refinements. The engineers labored hard to win approval for the inclusion of items and features that they honestly felt were indispensable. But their own former associates who then sat on the other side of the table often had to pare the specs. It would have been unfair to defer some power plants in toto and let others be built with full accoutrement of refinements.

Perhaps not too strangely the very engineers who had to be satisfied with less than they urged are now quite proud of the simplicity in design that resulted. Subconsciously they have swung over to a new pattern of thinking that augurs well for the utility managements and the utility investor. There is a new disposition to clinch the barebones trend of war-time design and to acknowledge that a couple of decades of reasonable tranquility can result in a considerable number of practices that, one by one, get confirmed as fully justifiable and essentially indispensable. But let a period of stress come along and the so-called indispensable items move across the imaginary line and take on the garb of the dispensable.

In short there is a wholesome disposition today to be critical about every item except the utterly indispensable ones. A steam plant can hardly function without a boiler, turbine condenser and feed pump. Next in order comes what? Thus the previous disposition to achieve simplicity by omitting one or two details of the highly refined plant seems to be giving way to a rather drastic approach. This approach goes to the other extreme of omitting *all* the refinements except those that can be proven in under today's conditions of full, labor, load-cycles, unit cost, etc. That mood puts the producer of the arguable items on his mettle as well as giving the plant designer a brand new opportunity to demonstrate that he believes that simplicity saves money, makes operation easier in abnormal periods and eliminates risks of complicated things going wrong at the worst time.

REA Contractors Form Protective Association

CONTRACTORS doing REA work have found it necessary to protect their interest through collective action and to that end have just formed the Rural Electrification Contractors Association. It is difficult to understand why REA permitted the practices against which complaint was made to grow to the point where the contractors had to resort to collective resistance, especially when a representative of that agency admitted that corrective measures were now being taken in certain instances and would be taken in others. Though rural electrification is a greatly favored activity with Congress, the administration of the funds which it provides is ever open to investigation and any unfair practices by REA are bound to bring discredit to the whole movement. For that reason REA officials must be ever vigilant to protect its good name for doing business according to recognized ethical and equitable standards.

While most of the contractors' complaints were recognized as needing remedial attention there is one on which REA is apparently adamant and that is the policy of not making awards to contractors doing work for neighboring utilities. If contractors were disqualified because of incompetency there could be no serious criticism of REA although other government agencies in the past have let contracts to the low bidder regardless, relying upon bonds for performance. But to deny work to an otherwise acceptable contractor simply because he was working for a competitor, and especially when government funds are involved, is not understandable.

One cannot help wondering why this policy is of such recent origin. Regardless of the reasons given, and they seem woefully weak, the suspicion remains that, with a limited number of qualified contractors and a shortage of labor, REA is using this means of intimidation to corner the contractor market and thereby handicap utilities in carrying out their rural line construction programs. That would hardly be consistent with its purpose of extending lines to rural dwellers who would otherwise be denied central station service unless REA now believes that it alone should be permitted to extend lines to all unserved rural areas. It is doubtful if Congress ever intended that to be a national policy.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Judicial Ratiocinations of FPC's Chairman

Late in June, 1944, Leland Olds' term as a member of the Federal Power Commission expired without action by Congress on his renomination. Before Congress reconvened that fall, a Senate sub-committee held hearings to consider the renomination.

When hearings were announced and those who actively favored or opposed the renomination were invited to appear, Olds was in bad odor with three groups—the privately-owned portion of the electric power industry; the natural gas industry and a substantial portion of the state regulatory commissions. It was anticipated that each, having engaged in a good deal of criticism of Olds' activities, would appear to state its grievance before a group specifically charged to hear such complaints.

Power Strategy

The gas industry was represented at the hearings, and by a man described as one of the most effective attorneys in that field. The state commissions made their complaints known, some by letter, some by personal appearance. The electric power industry chose to ignore the opportunity. One industry leader explains that it was decided that it would be easier to achieve desired changes in the Federal Power Act, aimed at junking the Jersey Central and Hartford precedents, if Olds were to remain in office than it would be if he were refused confirmation of his renomination. This sounds a little like the man who refused his physician's efforts to cure him of diabetes because "if I get well I'll get up and go outside and then I'll probably get pneumonia and it might kill me."

Thus it is that Olds, who might conceivably have been refused confirmation had the electric power industry added a calm, fact-loaded presentation of its case to the material presented by the gas people and the state commissions, is on hand today, a most un-judicial chairman of a quasi-judicial agency of federal government.

One of Olds' less judicial utterances was delivered recently before the Boren sub-committee investigating administration of the Holding Company Act. Olds, in complaining about private company attempts to defeat public ownership referendums, remarked in part that:

"Private enterprises in the field of such public businesses have no rights except to a reasonable return on their investment as long as they are operating the utility properties and the repayment of such investment if the properties are taken over by the public. . . . The making of the decision between private and public operation . . . should be free from the undemocratic influence and obstacles created by private enterprise using funds gathered from the operation of a public business."

Later, Olds, with resurgent judiciousness, conceded that such activities could properly be financed out of profits if they had to be engaged in.

After asserting that time so spent by private company employes should not be charged to operating expenses, Olds was asked by Representative O'Hara, Minnesota Republican.

"What about government employes who . . . make speeches on behalf of public power? Are they entitled to do that at public expense?"

"That is not the purpose of those speeches," Olds replied, with a straight face.

Questions Utility Defense Rights

Conceding that he had made speeches favoring public power while drawing government pay, Olds replied, unequivocally, to a question as to whether this would not excuse the assignment of utility employes to similar tasks:

"I think it would depend a good deal on the way in which it was done and the arrangement which was worked out."

O'Hara asked whether there is anything wrong with a private utility seeking to make known and defend its position regarding ownership.

"I do not think that there is anything that should stand in the way of an individual taking a position on a public question of this sort," Olds answered, "but I think that where you deal with a business which is essentially a public business . . . there is a grave question of whether the interests of democracy will be served by actual corporate and continuous corporate efforts to influence the election and the various political developments in favor of its own continued conduct of the enterprise."

Asked if he thought that only the public side should be allowed to electioneer, Olds replied, cogently:

"No, I think that certainly both sides of the question should be presented . . . to the people, but I think that they should be presented through the normal processes of democracy where individuals take sides and express themselves . . . I think anything where the scales are tipped by economic power rather than by the individual expressions of the people in accordance with democratic procedures is dangerous to democracy."

Against Excess Purchase Prices

Getting back to his original point that the price paid for the Nebraska Power Company was too high actually although not out of line relatively, Olds asserted, righteously:

"And the Commission (FPC) does not view with enthusiasm the paying of excess prices for utilities purchased by public bodies where the result is to reimburse holding company interests for write-ups before the results of the Commission's work have had time to be reflected in lower rates and consequently in lower market values for the properties. But the only alternative to paying the market value of properties, where public bodies decide for public ownership . . . would appear to be the creation of a competitive situation by initiating the construction and operation of competing systems."

These are some of the ratiocinations of the man whom it was decided could do the private power business more good in office than out of office. In their light, the reasoning behind that bit of strategy becomes more clear if not more attractive. The final results of the Boren sub-committee will evaluate that strategy.

NEWS OF THE WEEK

Wage-Price Policy Makes Price Relief Necessary

ELECTRICAL WORLD Survey Shows Manufacturers Must Have Higher Prices to Pay Higher Wages—Costs of Materials Also Rising—Later Results of Survey Will Indicate Size of Increase Needed to Assure Profit

The electrical manufacturing industry will require substantial price relief under the provisions of the Administration's new wage-price policy. First replies to a questionnaire distributed to the industry by ELECTRICAL WORLD reveal that producers cannot absorb the large increase in wage and material costs stemming from the new policy without prices higher than those prevailing in early 1941. The same manufacturers feel that if they are to meet the terms of the President's recent executive order further wage increases are inevitable.

Immediately upon announcement of the new wage-price policy ELECTRICAL WORLD wired a series of questions to manufacturers of electrical products in order to determine the effect of the policy on the industry. When completed, the inquiry will disclose the increase in cost of labor and materials since the start of 1941, the extent to which producers' estimate costs must still advance as a result of the administration's efforts to raise the general wage level, and the magnitude of the price increase required to assure even the low minimum profit rate permitted by OPA.

Replies to the survey have started to pour in, and the nature and magnitude of the serious pricing problem facing the industry is already clear. Hourly labor costs have risen anywhere from 15 to 65 percent. Moreover, the cost of materials has climbed steadily upward, in some instances as much as a third, although an advance of around 15 percent appears to be more typical.

In the face of these higher costs, prices of most electrical goods rest where they were more than five years ago. Even without piling further advances in wage and material costs on top of those which have accrued since early 1941, many producers feel increased prices are essential if they are to realize the limited profit permitted them.

The industry feels to a man that tremendous pressure will bring further wage increase demands as a result of the new criteria established by the President.

A wide disparity exists in the pay advances different electrical goods producers believe may be required to fulfill the administration's edict. Some estimates run higher than 20 percent; a few who have already granted substantial pay advances in recent months think it may take 5 percent or possibly less. Until a full report is in, a significant average cannot be struck.

Electrical goods producers surveying the position of their raw material suppliers foresee them facing similar wage-price problems. The end result is reflected in a unanimous agreement that material prices also must give way. Many companies estimate an increase of about 10 percent, although advances of as much as 20 percent are expected by some.

In his testimony to the House Banking and Currency Committee, Chester Bowles, the new Economic Stabilization Director, singled out the metal using industries as the one sector of the economy in particular need of price relief. Electrical goods manufacturers fall within this group.

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Julius Krug Named Secretary of Interior

Julius A. Krug, who resigned as head of the War Production Board on November 3, 1945, after having run the nation's power industry during its critical war years, is going back into the business as the result of his appointment by President Truman to succeed Harold L. Ickes as Secretary of Interior.

Indications are that there will be little opposition in the Senate to the man who joined the Tennessee Valley Authority in 1938 and has held many positions in the government since then, including a period in the Navy as a lieutenant commander. He is to take office on March 15.

Krug's return is at a time when Washington is alive with stories of a broad federal reorganization which is expected to centralize virtually all of the government's widespread power activities under the Interior Department.

Speculation as to the centralization reported brewing under the new federal reorganization bill includes:

1. Amputation of the power planning and coordinating activities of the Federal Power Commission and their transfer to Interior.

2. Transfer of the Army Engineers' power interests to Interior.

3. Retention by TVA of its autonomy.

Status of the Rural Electrification Administration under the proposed reorganization is not known. Under the leadership of former Secretary Harold L. Ickes, Interior campaigned vigorously to take over REA, and more recent speculation had REA's lending activities slated for the Reconstruction Finance Corporation while its power functions were said to be slated for Interior.

This amalgamation of federal power

interests is reported to be the first step in the governmental reorganization program which some observers expect to reach the capitol around May 1. It is reported that President Truman wants some tangible result of the enactment of the Reorganization Bill to present to Congress before it leaves Washington for an election year recess.

As Secretary of the Interior, Krug will be in no position to travel the middle road he maintained as Director of the Office of War Utilities. Numerous federal acts, including the Reclamation Act, the Bonneville and Fort Peck Acts, and the Flood Control Act of 1944, require that Interior be distinctly pro-public power.

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Wickard Advises Co-ops Not to Sell Out to Utilities

Rural Electrification Administrator Claude R. Wickard issued a dual warning to REA cooperatives last week to beware of the sale of co-ops to private electric companies and to press forward the concept of area coverage in farmline building.

Speaking before managers and directors of North Carolina REA co-ops, Wickard asserted that "Congress assuredly does not intend REA to lend money to any agency that neglects or refuses to extend service to every person in its area who can be reached under the liberal credit terms provided by law."

REA, Wickard continued, is "wholly dependent" for the carrying out of this mandate upon its "900 member-owned cooperatives." Private companies who obtained early REA loans showed little interest in extending rural service beyond areas where relatively good concentrations of customers were available.

The administrator stabbed at the practice of co-ops selling their holdings to private companies with the assertion that "power companies become increasingly avid for high-paying rural areas when low-cost public power appears to be in the offing." Such sales, while very few in number, have happened often enough in recent months to cause concern, an REA official declared, adding that the principal worry in REA is over the fact that co-ops usually sell for settlement of the co-op's loan from the government, plus return of contributions by members, with no provision for whatever equity has been built up by the co-op.

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Free Installations Offered

Nebraska Power Co. has offered to make free installations of electric lines that may be used for emergency housing for veterans in suburban Omaha.

Bill Would Put REA Loans Up to States

Rep. Harris Proposes That State Regulatory Commissions or FPC Pass on Loans to Cooperatives

Rural Electrification Administration loans for the acquisition, construction or enlargement of generating stations and transmission lines would be subject to approval of state regulatory commissions under the terms of a bill introduced last week by Rep. Oren Harris, Ark. Dem.

Other proposed amendments would forbid acquisition loans for the purchase of facilities used to serve inhabitants of a municipality of more than 1,500 persons and would forbid such loans to municipalities of less than 1,500 inhabitants unless a majority of such inhabitants had approved such acquisition by ballot, petition, or otherwise.

The bill would authorize additional loan funds of $150,000,000 yearly for three years and would allow use of such funds without regard to the provisions of the REA Act designed to channel the funds into all states.

Another Version of Poage Bill

The bill was believed to be the House Interstate Commerce Committee's version of the Poage Bill which has been stalled in committee for more than a year and on which extensive hearings were held last fall. The Poage Bill, originally introduced in 1944 by Rep. W. R. Poage, Texas Democrat, and Sen. Scott Lucas, Illinois Democrat, provided for $585,000,000 over three post-war years for rural lines extension, and further provided $5,000,000 yearly for project planning. The Lucas Bill passed the Senate with an amendment reestablishing REA as an independent agency, and was never considered in the House.

The Poage Bill, reintroduced early last year, was vigorously supported by REA and the National Rural Electric Cooperative Association. It was opposed as unnecessary by numerous private company officials, representing the Edison Electric Institute and The National Association of Electric Companies.

An REA spokesman indicated that the agency is not particularly concerned about the Harris Bill despite its restrictive provisions, making the obvious point that it would be extremely difficult to obtain enactment of the measure in its present form. About all that the Harris Bill leaves REA in the way of net gain is the commitment of appropriations over a period of more than one year, and this is of small value today in view of Congress' willingness to speed deficiency bills through to enactment.

The Harris Bill amendment which would subject loans for generating or transmission facilities to state approval provides that where no state regulatory agency exists, permission would have to be obtained from the Federal Power Commission. FPC would be authorized to grant such permission only where it could demonstrate that such loans would provide electricity at lower rates than could otherwise be obtained by the borrower.

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CPA Planning Order Limiting Construction

An order restricting construction of just about everything except housing and those types of public works which do not interfere with housing is being prepared by the Civilian Production Administration.

Designed to clear the tracks for the vast veterans housing program, the order, as described by CPA officials, would amount virtually to a return to the wartime standards of L-41, the late construction order.

As presently planned, the forthcoming CPA order is expected to permit construction of transmission and distribution lines and dams but will probably include a ban on construction of powerhouses. Efforts are being made to write into the pending order reasonable exemptions for such construction as power houses and other public service plants, but there is now no guarantee that the effort will be successful.

A federal committee has ruled that construction of highways, reclamation, rivers and harbors, and flood control projects will not interfere with the housing program.

Rules regarding industrial buildings under construction at the time the order takes effect are not yet final, but it is anticipated that such projects will be required to be cleared for continuation, with clearance based on a demonstration of essentiality.

It is hoped that the order will be issued by the end of the first week in March.

One CPA official said that the move for reasonable exemptions for public service plants will be based on the fact that such buildings are required to house industrial equipment necessary to all civilian activity. Electric utilities which have equipment on order for installation in powerhouses yet to be constructed will be forced to cancel equipment orders if they are not assured of housing for such equipment at the time of delivery, it was pointed out. This, it was said, would lead to a dislocation which would be more damaging than could be justified by the limited amounts of materials and labor saved by curtailment of such construction.

Utilities Battle Proposed SPA Transmission Grid

11 Electric Companies Offer to Buy All Energy Which SPA Has or Will Acquire from New Army Dams—Interior Department Seeking $23,000,000 for Start of $200,000,000 System Which Would Extend over 5 States

The struggle for control of electric power in the near Southwest, which had burned steadily if restrainedly during the war, flamed openly in Washington this week as both sides carried the battle to a Congressional committee considering appropriations for the projected $200,000,000 five-state Southwestern Power Administration transmission system.

Interior Department officials, including Douglas Wright, SPA Administrator, appeared first before the House Appropriations subcommittee holding hearings on the fiscal 1947 Interior Department Appropriation Bill. They were to be followed by executives of a number of southwestern utilities.

As sent to the committee, the bill carried a budget request of $23,000,000 for first construction of the system, aimed ultimately at consisting of an estimated $125,000,000 worth of transmission lines and another $77,000,000 worth of fuel-electric plants, all installed to firm and market the energy scheduled to be developed at two-dozen-odd Army Engineer hydroelectric plants in Texas, Arkansas and Oklahoma.

Utilities Seek Public Power

The struggle burst into the open last week when executives of 11 southwestern utilities communicated with Wright offering to buy all the energy which SPA now has and will acquire as the engineer dams come into operation. SPA was designated marketing agent for this power by the Interior Department which won jurisdiction over army energy in the Flood Control Bill of 1944.

The executives offered to distribute the energy under such regulations as might apply and to pass on to consumers savings realized from low-cost federal generation. They agreed further to observe all preferential rights established by federal legislation. Invariably, federal energy is directed to be sold first to the federal government, then to state and local groups, then to non-profit bodies and co-ops, and thereafter to "other persons."

The companies argued that their proposition is "the only reasonable and fair manner" in which the duties imposed on Interior by the 1944 Flood Control Bill can be fulfilled and added that their plan "will provide full and complete integration of power supply for the area, with the smallest expenditure of federal or private funds."

The proposition was signed by these presidents: C. Hamilton Moses, Arkansas Power & Light Co.; Frank M. Wilkes, Southwestern Gas & Electric Co.; R. K. Lane, Public Service Co. of Oklahoma; James Hill, Jr., Arkansas-Missouri Power Corp.; W. O. Turner, Louisiana Power & Light Co.; George A. Davis, Oklahoma Gas & Electric Co.; J. E. Harsh, Empire District Electric Co.; R. S. Nelson, Gulf States Utilities Co.; M. F. Gill, Kansas Gas & Electric Co.; and J. C. Happeny, Oklahoma Power & Water Co.

May Bid For Ark-La Line

It was reported that the group would make a similar offer to purchase the Ark-La line, a 154-kv. transmission line linking the Pensacola Dam on northeastern Oklahoma's Grand River, and the unused steam-electric plant at Jones Mills, Ark., in which no units have been installed although under war plans, space was provided for two 35,000-kw. turbines. The Ark-La line, around which swirled the bitterest public-private power fight of the defense-war era, is owned by an REA-financed transmission cooperative which built it to move Pensacola power to the Jones Mills aluminum plant. The line is now unused.

Indication of the feeling in the present struggle is had from the statement of Mr. Moses, who declared that full realization of the SPA proposal would mean the end of his company "in five years."

The $23,000,000 budget item which Interior is seeking to hammer through Congress in the 1947 appropriation bill includes the following items:

Transmission and substations—$11,151,635; fuel-electric generating facilities—$6,688,230; feeder lines, service connections and miscellaneous capital additions—$3,460,085; plans and specifications for future programs—$500,000; general plant and equipment—$200,000; administration and general expenses—$1,000,050.

The projected SPA transmission grid would extend from Beaumont, Texas, and Lakes Charles, La., on the south, to a point near San Antonio, on the southwest; to Woodward, Okla., on the northwest; Joplin and Springfield, Mo. on the north; a point near Cape Girardeau, Mo., on the northeast, and Newport, Ark. and Monroe, La., on the east.

This system, of course, is projected as a 20-year construction job, to be filled in as the Army dams whose energy it is designed to transmit, go into operation. The same is true of the proposed 770,000 kw. of steam-electric capacity to back up the hydro. It would entail 14,768 miles of transmission lines estimated to cost $76,133,000; 1,325,000-kva. of transmission substation capacity, estimated to cost $16,350,000; and 2,360,000-kva. of distribution substation capacity, estimated to cost $32,517,000.

Backbone of the system would be a 154-kv. line extending southeast from a point near Joplin, Mo. to Table Rock, Bull Shoals and Norfork Dams in north central Arkansas, thence southeast to a point near Newport, Ark., where it would veer southwest to Little Rock. Near Newport, it would branch northeast to a point near Cape Girardeau, Mo. A spur of this line would extend northwest to south central Missouri, and another spur would extend north from a point near Table Rock to Springfield, Mo. The remainder of the system would be in 132-, 110-, and 66-kva. lines.

Private company people in the area are particularly concerned over the prospect raised by the existence of the preference requirement in sale of federal power. Under a power policy issued by Harold L. Ickes, shortly before he resigned as Interior Secretary, Interior people were directed to lend "active assistance, from the very beginning of the planning and organization of a project . . ." to the creation of preferred customers for federal power.

The proposed SPA system, it is felt, will allow tax-free federal power to be transported to cities which will be offered very low wholesale rates if they municipalize their distribution system. SPA and other similar federal agencies may sell direct to industrial customers and to distribution systems but may not distribute energy themselves. Therefore, cooperatives in rural areas and municipal systems in urban territory are the best hope that federal power marketers have of selling their energy other than to private utility companies.

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Energy Tax Less in 1945

The Treasury Department announced this week that receipts from the federal 3.3 percent sales tax on electric energy slumped in 1945 to $55,561,010.65 from $56,307,211.96 in 1944.

Cable Duty, Secondary Adequacy, T. & D. Themes

Broad Program of E.E.I. Committee Records Favorable War-Time Cable Performance, Questions Validity of Ratings — Buffalo Storm Reopens Dancing Conductor Issue — Data on Carrier Attenuation Supplied

Few utilities experienced cycles or levels of cable loading during the war, despite their fears or expectations, that taxed the capabilities or led to adverse performance. This, along with discussion of the published ratings and of new fault locaters, was one of the major topics at the two-day meeting of the E.E.I. transmission and distribution committee in Cincinnati on February 18 and 19; attendance was 125.

Discussion of cable operating experience indicated that loadings in very few cases reached such values as to approach the published emergency-loading temperature limits. Favorable load factor in Detroit was offered by G. B. McCabe, Detroit Edison Co., as the explanation of a two-thirds decrease in both total and inherent faults per 100 miles per year. C. D. Brown, Wisconsin Electric Power Co., also said the feared loadings did not materialize. He cited applying 200 patches necessitated by sheath cracks on older cables with widely varying loads; split sleeves were applied over the cracks, mostly occurring near joints. T. H. Haines said the Boston Edison Company avoided the resulting stiffness by applying a flexible copper sleeve.

Whether the published ratings have been based on the actual capabilities of modern cables was questioned by E. W. Osterreich, Duquesne Light Co. He suggested that economical utilization of cable investment might well ignore some of the guarantees and base the assigned loading on performance and duty with fuller realization that the crux is temperature range rather than temperature level. T. G. Hieronymus, Kansas City Power & Light Co., felt further that more recognition be accorded in the standards to the variants that account for so much of the difference in cable performance and experience. Osterreich asserted that the widespread program of straightening out of vaults and cable training had apparently stepped up the sheath troubles since the days when so many vaults had the appearance of scrambled spaghetti.

Methods of fault location were classified by W. A. Upham and Floyd Buck, United Illuminating Co. They detailed a condenser discharge equipment built for use on both aerial and underground cables. J. T. Schott, Bell Laboratories, described the Lookator which, in effect, looks into the cable system and sees (on a cathode ray screen) a distant fault reflected from any point of change in line impedance. G. D. Harding, General Electric Co., detailed a direct method involving use of a thyratron, interruptor, rectifier and current-limiting reactor.

After years of merely casual interest in dancing conductors the Buffalo utility on December 26, 1945, experienced 220 disturbances in that single day (some 317 tripouts of 66 and 110-kv. lines at seven points) against two disturbances in the whole month of January. Service interruptions were not too bad, said R. C. Gerhardt, adding that the downtown network was off only three minutes. Lines tripped off with such frequency that conventional glaze melting procedures could not be followed. The bulk of the trouble was with the lower conductors.

Shortage of single-phase motors is resulting in a deluge of requests for service for polyphase motors on prospective air conditioning installations. This came out in a report by J. W. Anderson on the negotiations with the manufacturers. In discussion of the propriety of transition to 3-phase secondary, D. K. Blake, General Electric, said his studies convinced him that even reversed refrigeration loads for house heating would not force abandonment of prevailing 3-wire 230/115-volt secondary systems.

Advocacy, by several participants, of more information on load characteristics was met by preliminary consumption and diversity data on a 90-home development served with economy by rear-lot line distribution.

MEDIATION—Representatives of the Duquesne Light Co. and of the union involved in the recent strike meet with mediators from the federal, state, and city governments. Little progress was made, and another strike is threatened for next week

Contractors Band to Fight Policy of REA and Co-ops

Protests at Chicago Meeting Include "Chiseling," Slow Pay, Poor Specifications, and Discrimination on Part of Cooperatives — W. P. Cagney, Jr. Heads Rural Electrification Contractors Association

Contractors engaged in building REA lines throughout the country raised their voices last week in vigorous protest against policies and practices of REA and the co-ops which, they charged, are placing an unfair financial burden on the contractor and contributing unnecessarily to the cost of line construction.

Meeting at Chicago the 125 line construction contractors, their bonding agents, and material suppliers from 36 states charged specifically that:

Co-ops are resorting to "negotiation" and unfair "chiseling" in attempts to undercut prices submitted by low bidders on line construction contracts.

Extreme tardiness of co-ops in paying on monthly work estimates and delays in final settlement is placing an unfair financial burden on the contractor that is bound to reflected in prices bid on new work.

Unjust Discrimination Charged

REA's policy of discriminating against contractors doing work for private utilities is unjust.

Specifications for lines on which contractors are asked to bid are so woefully incomplete that they often have no idea of where the line is to be built or the amounts of material involved.

That the REA contract form unfairly binds the contractor and his bonding agent.

Out of the meeting a new association emerged—The Rural Electrification Contractors Association—avowed purpose of which is to represent the views of the contractors and to coordinate their efforts with those of other agencies to the end of securing better operations at lower cost.

Morris DeWitt, Porter DeWitt Construction Co., Poplar Bluff, Mo., saw in "negotiation" a threat to the contract system and free open competition. "If we do not want to negotiate no one can make us, particularly on the present sellers' market. Nor does any contractor have to sit in a room and listen to a demand that he reduce his bid when he has been low bidder in open competition," DeWitt asserted. Competition will take care of prices in the natural course of events if they are seriously out of line, he pointed out in calling upon all contractors to hold the line against the "socialistic tendency" of REA toward negotiation.

Delay in making payments as construction progresses and tardiness in making final settlements—ranging from four months to two years—is in effect converting construction contractors into underwriters for the REA program, W. P. Cagney, Contracting & Material Co., Evanston, Ill., declared. These delays are forcing contractors to turn to banks for operating funds. Interest on these loans—a cost to the contractor—doesn't appear in his contract cost.

Cagney further charged that certain individual co-ops are deliberately using federal funds allocated to construction for the purchase of materials and other purposes. "If REA will keep the co-ops from dipping into the till to pay others off ahead of the contractor, one of our problems will be solved," Cagney stated. Cagney also suggested that REA advance money to contractors for material delivered to the site but not installed because of shortages of certain strategic items.

Specifications for line construction projects were another sore spot with the contractors. Harry L. Cater, Cater Electric Construction Co., Kansas City, Mo., asked co-op engineers to "give us a set of plans so we will at least know where the line is going to be built." He also recommended that a "rock clause" be provided in contracts to permit contractors to move structures slightly when rocks interfered.

A. S. Church, Central Electric Co., Battle Creek, Mich., cited an instance in which his company, having been successful bidder on a project in his neighborhood, was informed through REA channels that the bid had been disqualified because they were doing work for a neighboring utility—not because of inability to do the job.

Invited by the contractors to reply to their complaints, J. K. O'Shaughnessy, Chief of the Design and Construction Division of REA, gave assurances of immediate relief from several of the conditions mentioned. He disclosed the issuance of Engineering Memorandum No. 165, dated February 15 (the meeting was held February 18-19) authorizing contractors to request an amendment to construction contracts calling for 90 percent payment of materials delivered to the site but not installed.

O'Shaughnessy saw justice in the contractor's complaint over the slowness of payment. An engineering memorandum has been prepared and probably will be issued around February 28 in which he said co-op managers are being urged to make payments on monthly work estimates as soon as invoices are submitted and to see that funds are on hand to make payments when due. O'Shaughnessy said that co-op managers who use federal loan funds for purposes other than those for which they were authorized are misappropriating these funds and are guilty of some misdemeanor.

He questioned Morris DeWitt's familiarity with REA's policy on negotiation and cited Engineering Memorandum No. 164 of December 12 which states that REA "will not approve any negotiated contracts unless started prior to Decem-

ORGANIZERS—Behind the meeting of REA line construction contractors which led to the formation of the Rural Electrification Contractors Association was this committee, left to right, R. N. Campsey, H. L. Cater, and W. P. Cagney

ber 12, 1945." O'Shaughnessy declined, however, to discuss REA's policy with respect to contractors doing utility work, other than to say, "There are good reasons for establishing this policy." According to O'Shaughnessy, the policy states that "Award of contracts shall not be approved if facts indicate that the contractor has *interests in conflict* with those of the borrower."

Officers of the newly organized Rural Electrification Contractors Association elected for the coming year were: President, W. P. Cagney, Jr., Contracting & Material Co., Evanston, Ill.; vice-president, R. N. Campsey, R. N. Campsey Construction Co., Denver; secretary, Paul Wallack, Walco Engineering & Construction Co., Tulsa; and treasurer, S. O. Sorkness, Sorkness Construction Co., Fargo, N. D.

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CPA Acts to Spread Steel Equitably During Shortage

Steel deliveries during the period required by the industry to resume full operation are to be spread as equitably as possible among all users, Civilian Production Administration has made it plain in a four-point policy under which:

1. All producers shall ration all deliveries so that no individual customer or class of customers will receive more steel than is needed for immediate use.

2. All producers shall supply the minimum needs of the largest possible number of their customers, giving to each his fair proportionate share.

3. All producers shall schedule shipments to warehouses and distributors so that they may make deliveries of standard items in order to permit continuation of supply of production materials for small business and to continue to supply items required for maintenance and repair purposes.

4. All producers shall schedule shipments of semi-finished materials to non-integrated producers so that these producers' operations may be maintained at an equitable rate.

The policy provides also that priority ratings on steel, which were suspended just before the strike began, will remain suspended until steel supply is such that they can be reinstated without hampering production.

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Transformer Station Sold

The Philadelphia Electric Co. has been authorized by the Pennsylvania Public Utility Commission to sell its electric transformer station facilities located on the premises of the Philco Corp. to that firm for $6,197.97.

Electrical Companies Get Chemical Award

Of the 127 companies, universities, and research organizations which shared the Seventh Award for Chemical Engineering Achievement for their contributions to the atomic bomb project, 49 of the companies are in the electrical field.

Presentation was made Tuesday at a dinner in New York with Maj. Gen. Leslie R. Groves, executive officer in charge of the Manhattan District, accepting the award on the behalf of the atomic bomb project and the other recipients who made significant contributions to the research, development, and engineering phases of the project.

The award is sponsored by *Chemical & Metallurgical Engineering*, and its editor, S. D. Kirkpatrick, served as secretary of the award committee of 51 members, all faculty members of universities.

The companies in the electrical field who were honored are Allis-Chalmers Manufacturing Co., Aluminum Co. of America, American Cyanamid Co., Babcock & Wilcox Co., Bakelite Corp., Baker & Co., Bell Telephone Laboratories, Inc., Brush Laboratories, Bryant Electric Co., Carbide & Carbon Chemicals Corp., Chapman Valve Manufacturing Co., Combustion Engineering Co., Cook Electric Co.

E. I. duPont de Nemours & Co., Electro-Metallurgical Co., Elliott Co., Fansteel Metallurgical Corp., Ford, Bacon & Davis, Inc., Foster Wheeler Corp., General Electric Co., Girdler Corp., Grinnell Corp., Handy & Harman, Inc., International Nickel Co., C. O. Jelliff Manufacturing Corp., Kellex Corp., M. W. Kellogg Co., Linde Air Products Co., Link Belt Co.

Monsanto Chemical Co., National Carbon Co., Norton Co., Phelps-Dodge Co., Revere Copper & Brass, Inc., Sargent & Lundy, A. S. Schulman Electrical Co., Sharples Corp., A. O. Smith Corp., Standard Oil Co. (N. J.), Standard Oil of Indiana, F. J. Stokes Machine Co., Stone & Webster Engineering Corp., Taylor Instrument Cos., Tennessee-Eastman Corp., Vascoloy-Ramet Corp.

Western Electric Co., Westinghouse Electric Corp., Worthington Pump & Machinery Corp., York Corp.

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Plant Capacity Increased

Kosciusko, Miss., has purchased a 1,225-hp. unit for its municipal plant and has nearly doubled its capacity.

MEETINGS

Pennsylvania Electric Association—Prime Movers Committee, Roosevelt Hotel, Pittsburgh, Pa., March 21-22. N. J. Walker, chairman, Philadelphia Electric Co., Philadelphia, Pa.

Previously Listed

National Rural Electric Cooperative Association—Annual meeting, Buffalo, N. Y., March 4-6. Avery C. Moore, secretary-treasurer, 416 5th St., N. W. Washington 1, D. C.

Oklahoma Utilities Association—Annual convention, Biltmore Hotel, Oklahoma City, Okla., March 11-12. Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City 2, Okla.

North Central Electrical Industries—Convention and trade exposition, Radisson Hotel, Minneapolis, Minn., March 11-13. W. A. Ritt, secretary-manager, 234 Foshay Tower, Minneapolis, Minn.

Southeastern Electric Exchange—Engineering and Operation Section, Tutwiler Hotel, Birmingham, Ala., March 14-15; annual conference, Edgewater Gulf Hotel, Edgewater Park, Miss., April 24-26. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 1, Ga.

Pennsylvania Electric Association—Electrical Equipment Committee, Roosevelt Hotel, Pittsburgh, Pa., March 21-22 (postponed from February 14-15). B. E. Hagy, chairman, Philadelphia Electric Co., 900 Sansom St., Philadelphia, Pa.

American Society of Mechanical Engineers—Spring meeting. Hotel Patten and Reid House, Chattanooga, Tenn., April 1-3. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Edison Electric Institute—General sales conference, Edgewater Beach Hotel, Chicago, Ill., April 2-4. Col. H. S. Bennion, managing-director, 420 Lexington Ave., New York 17, N. Y.

Midwest Power Conference—Annual meeting, Palmer House, Chicago, Ill., April 3-5. S. E. Winston, director, Illinois Institute of Technology, Chicago 16, Ill.

National Electrical Manufacturers Association—Spring meeting, Palmer House, Chicago, Ill., week of April 8. W. J. Donald, managing director, 155 E. 44th St., New York 17, N. Y.

Missouri Valley Electric Association—Engineering conference, Hotel Continental, Kansas City, Mo., April 10-12. I. D. Pettegrew, director, 1004 Baltimore St., Kansas City 6, Mo.

Electrochemical Society—Spring meeting, Tutwiler Hotel, Birmingham, Ala., April 10-13. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York 27, N. Y.

National Electrical Wholesalers Association—Annual convention, Stevens Hotel, Chicago, Ill., April 21-25. C. G. Pyle, managing director, 500 Fifth Ave., New York, N. Y.

Society of the Plastics Industry—National plastics exposition, Grand Central Palace, New York N. Y., April 22-27. John Wetherby, secretary, 295 Madison Ave., New York 17, N. Y.

American Institute of Electrical Engineers—Northeastern district, Buffalo, N. Y., April 24-25. H. H. Henline, secretary, 33 W. 39th St., New York 18, N. Y.

International Lighting Exposition—Stevens Hotel, Chicago Ill., April 25-30. A. B. Coffman, manager, 111 W. Jackson Blvd., Chicago 54, Ill.

National Association of Corrosion Engineers—Annual convention, President Hotel, Kansas City Mo., May 7-9. Elton Sterrett, executive secretary, 318 Southern Standard Bldg., Houston, Texas.

Great Lakes Power Club—Spring meeting, Palmer House, Chicago, Ill., May 24. Almer Skretting, secretary-treasurer, Wisconsin Electric Power Co., Milwaukee 1, Wis.

Pennsylvania Electric Association—Engineering Section, all committees, Penn Harris Hotel, Harrisburg, Pa., May 28-29. E. B. Shew, chairman, Philadelphia Electric Co., Philadelphia 5, Pa.

SPA Tells Congress of Surplus Marketing

Federal purchases of electrical machinery and equipment during the war totalled $8,300,000,000, of which less than 0.7 percent had been declared surplus last November 30, the Surplus Property Administration has reported to Congress.

SPA asserted that "it is not expected that large amounts of heavy equipment suitable for central power stations, industrial power plants and marine propulsion will appear as surplus," and added that "many plant installations will not be put on the market except with the plant itself."

Declarations of small generator sets, gasoline and diesel driven, account for $20,000,000 of the $56,000,000 worth of electrical machinery and equipment which had been declared surplus as of last November 30. Many of these units went overseas and will not be returned, the report stated, adding that "on the whole, the market for generator sets is good at the present time."

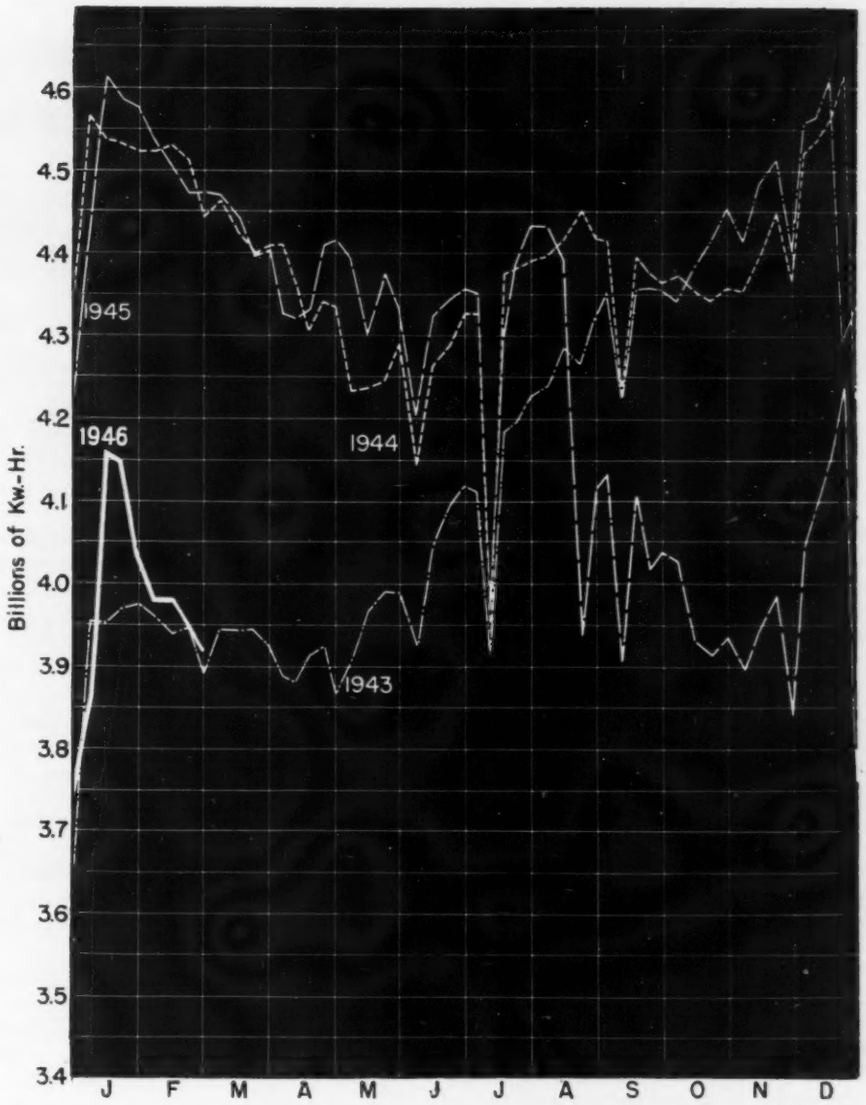
Transformers Move Fastest

Power and distribution transformers valued at $2,300,000 have been declared surplus "and have moved more rapidly than any other type of electrical equipment." Some special types designed for odd voltages are being sold to foreign governments and can be modified for domestic needs, SPA declared, adding:

"There is a good market for this equipment. Much of it, however, is in industrial plants and military installations where it is likely to remain."

Up to last November 30, $16,900,000 worth of insulated wire and cable had been declared surplus, according to the report which noted that "there is a good market for rubber-covered and weatherproof types and for magnet wire." One of the problems is the existence of large amounts of cable made to U. S. and British Navy specifications for shipboard use. No present Navy use exists, and the commercial uses are limited.

Commenting on disposal methods used in conjunction with electrical machinery and equipment, the report disclosed that "the predominant method at the present time is that of direct sale to priority claimants and to the general public. For bulk items, the method of sale through dealers is also widely employed, either by negotiation, upon a bid basis, or upon a fixed price basis. In the latter case, where items are in long supply, a discount may be offered to the dealers. It is probable that prompt and wide distribution may be facilitated by additional methods, such as sale through agents or approved brokers upon a commission basis."



Output Curve Again Moves Downward

The electric output curve moved downward again during the week ended February 23, 1946, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 3,922,796,000 kw.-hr., compared with 3,948,620,000 kw.-hr. during the preceding week. During the week ended February 24, 1945, the amount of electrical energy distributed amounted to 4,473,962,000 kw.-hr., this year's figure representing a decrease of 12.3 percent.

In all of the seven major geographical regions of the country but one, output was below that of the corresponding week in 1945, the Rocky Mountain group continuing as the one exception with an increase of 2.0 percent. For the preceding week it showed an increase of 4.7 percent as compared with the corresponding week of 1945. The biggest drop was reported by the Central Industrial States, which showed a decrease of 20.5 percent. The Southern States reported the second highest loss, a decrease of 13.2 percent. Pacific Coast dropped 10.0 percent.

Weekly Output, Millions Kw.-Hr.

1946		1945		1944	
Feb. 23	3,923	Feb. 24	4,474	Feb. 26	4,445
Feb. 16	3,949	Feb. 17	4,472	Feb. 19	4,512
Feb. 9	3,983	Feb. 10	4,505	Feb. 12	4,533
Feb. 2	3,983	Feb. 3	4,539	Feb. 5	4,524
Jan. 26	4,034	Jan. 27	4,577	Jan. 29	4,524
Jan. 19	4,145	Jan. 20	4,588	Jan. 22	4,532
Jan. 12	4,163	Jan. 13	4,614	Jan. 15	4,539
Jan. 5	3,865	Jan. 6	4,427	Jan. 8	4,568
1945		1944		1943	
Dec. 29	3,759	Dec. 30	4,226	Jan. 1	4,337†
Dec. 22	4,239	Dec. 23	4,617	Dec. 25	4,295
Dec. 15	4,154	Dec. 16	4,563	Dec. 18	4,613
Dec. 8	4,097	Dec. 9	4,538	Dec. 11	4,567

†1944

Percent Change from Previous Year

	Week Ending		
	Feb. 23	Feb. 16	Feb. 9
New England	— 6.4	— 4.2	— 2.1
Mid Atlantic	— 5.2	— 6.0	— 3.0
Central Industrial	— 20.5	— 20.0	— 19.4
West Central	— 3.4	— 1.0	— 3.3
Southern States	— 13.2	— 12.7	— 13.9
Rocky Mountain	+ 2.0	+ 4.7	+ 3.0
Pacific Coast	— 10.0	— 9.2	— 10.0
Total United States	— 12.3	— 11.7	— 11.6

E.E.I. Committee Discusses Utility Operation Practices

Electrical Equipment Group Learns That Economical Operation and Ability to Overhaul Comfortably May Necessitate Capacity Additions — Apparatus Was Kept Up During War — Simplicity Is New Watchword

Economical operation and ability to overhaul comfortably are as likely to demand capacity additions as computations based on probability of concurrent outages. Apparatus was kept up during the war. Simplicity is the new watchword in excitation and auxiliary systems in power plants. These were major conclusions at a meeting of the Edison Electric Institute's Electrical Equipment Committee at Cincinnati, February 20 and 21. Attendance was about 60.

Following a description of an elaborate analysis of concurrent outages on an IBM machine by E. S. Loane and C. W. Watchborn, Pennsylvania Water & Power Co., and an outline of the generation reserve practices of the Pa.-N. J. interconnection by Supervisor H. W. Phillips, there was active discussion of the issues. Approaching equality of day and evening peaks, said Phillips, may force additions solely to afford opportunity for maintenance. E. H. Snyder, Public Service Electric & Gas Co., Newark, felt that additions justified by economy objectives often afforded the margins needed for maintenance programs. J. H. Foote, Commonwealth & Southern Corp., said curves projected on past experience are often bettered because apparatus reliability has steadily increased.

Excitation Proves Interesting

Reporting of the significant electrical features of Baltimore's Riverside station by G. P. Fallon stimulated a lively discussion of station auxiliary and excitation supply. Consensus on excitation was that there is practical equivalence between the direct connected, the gear-driven, and the motor-driven exciter if each is appropriately applied. H. W. Eales said anyone thinking any of the methods is foolproof is merely fooling himself because human beings can always circumvent. R. T. Henry, Buffalo Niagara Electric Corporation, reported having all three and C. T. Hughes, Connecticut Light & Power Co., likewise adding that there has been no trouble with 3,600-rpm. exciter commutators in the year since they were corrected.

As for auxiliary supply J. H. Foote urged simplicity on the ground that complex safeguarding schemes merely multiply the sites for trouble. S. C. Townsend said Pennsylvania Power & Light Co.'s new Sunbury plant would have a transformer on the generator leads for house service (three motored exciters).

Comprehensive installation of factory-assembled switchgear at Stamford in 1941 was described in detail by J. P. Lewis, Connecticut Power Co., and several commentators characterized it as a complete job. E. H. Snyder's question about the proper location of boiler room cubicles brought from Henry the suggestion that dirt and water seepage can best be avoided by providing an enclosed space. R. W. Wilbraham, United Engineers & Constructors, concurred and added that money could be saved by running power leads in troughs like control cables; Chairman H. S. Fitch said this was being done at West Penn's Springdale plant. E. B. Shew, Philadelphia Electric Co., said it would be done with 440-volt circuits at Southwark station.

Southwark Lighting Described

Realization that many power plants could well have improved lighting was manifested in Shew's enumeration of the decisions made for the new Southwark plant. Incandescents will be limited to battery rooms, stairways, small rooms and emergency lights. The turbine room and heater bays will have combination incandescent-mercury units (7-8 footcandles); cold cathode fluorescent will be applied in switch areas and corridors (10 footcandles). H. J. Klumb, Rochester Gas & Electric Corp., asked what measures could be applied to determine the benefits from bettered lighting in old plants. Shew had emphasized deterioration; Fitch said it cost four times as much to wash walls in a plant as to paint them. Foote felt that the power plant problem should be recognized essentially as the vertical-surface illumination problem encountered in airplane assembly plants.

Consensus was that there was no broad foundation for isolated reports that maintenance schedules had been relaxed and that equipment had deteriorated or been neglected. I. W. Gross read excerpts from reports to the recent Doble Engineering Conference by client utilities, one after another indicating close adherence to the programs during the war and strong support for the philosophy of preventive maintenance, particularly by insulation tests and observations.

A new recording attachment for thermal demand meters employs a heated stylus pressed at intervals against the chart, according to J. A. Morris, AGESCo, who discussed demand metering for small loads. Detroit has 19,000 thermal demand meters, said W. G. Knickerbocker, and he said a comparable ratio for the country would mean only 3,400 demand meters for each 100,000 customers, hardly a market large enough to promise the low production cost and price desired by the utilities. Raising base from ½ to 3 kw. also would eliminate 70 percent of the meters.

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Oregon P.U.D Fights Sale of Eastern Oregon Utility

A dispute over the California Pacific Utilities Co.'s attempt to buy Eastern Oregon Light & Power Co. properties continued to develop last week, with the People's Utility District of Union County, Ore., contesting the projected sale.

Giving as grounds for objection the failure of Eastern Oregon to notify the P.U.D. that a purchase agreement had been reached with California Pacific, Union County P.U.D. is requesting a Public Utilities Commission hearing on the projected sale, indicating that if it is unable to buy Eastern Oregon facilities, it will construct its own electric system.

The offer of between $2,200,000 and $2,500,000 which had been made previously by the P.U.D. for purchase of the Eastern Oregon properties was approximately the same as the California Pacific offer.

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Louisville Gas & Electric Assessment Suit Winner

A suit of the City of Louisville, Ky., to increase the 1943 tax assessment on the property of the Louisville Gas & Electric Co. has been dismissed by Judge W. B. Ardery, of the Franklin County Circuit Court.

The State Tax Commission fixed the utility's 1943 assessment value at $52,000,000, including franchise, real estate, machinery, equipment and other tangible property. The city tried to have this raised between $6,000,000 and $8,000,000.

Judge Ardery ruled that the transformers of the utility and the foundations under its turbine generators are part of its manufacturing machinery which is exempt from local taxation. Louisville had claimed otherwise.

How

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Design For Patrolman's Suspension Bridge

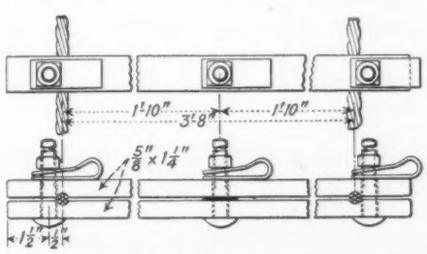
W. A. SCHULZ
Transmission Engineer,
Public Service Co. of Indiana, Inc., Indianapolis

Illustrated herewith is the patrolman's suspension bridge built by the Public Service Co. of Indiana, Inc., over the White River near Medora, Ind. Design of this bridge, built in 1942, has since been generalized and is being used by the company for all patrol bridges on the system.

The Medora bridge has a span of 225 ft. and rises approximately 20 ft. above the river bank. Three guy strands which comprise the bridge "cables" were strung to an initial sag at 30 deg. F. of 9 in. in 225 ft. They dead end on thimble eye bolts in angle iron crossarms bolted to terminal poles of appropriate height. Terminal poles are heavily guyed in three directions. Anchor rods for head guys are provided with turnbuckles for adjustment from time to time as needed.

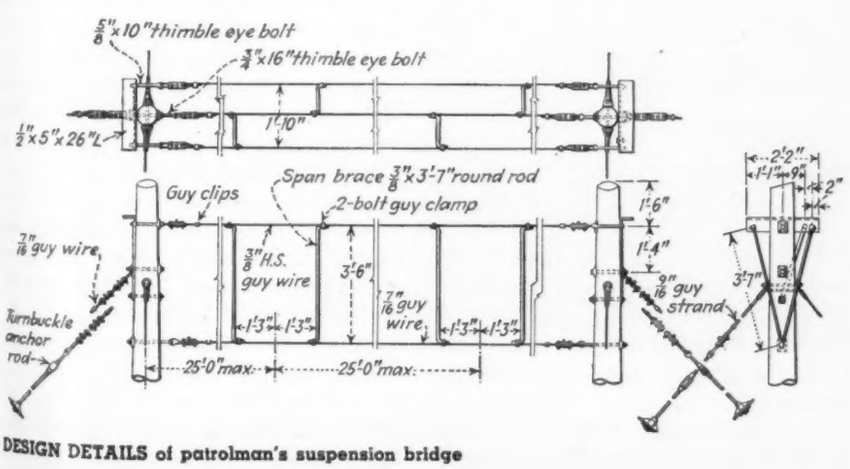
The three principal bridge cables are arranged in triangular configuration, apex down. Base dimension of the triangle is 1 ft. 10 in.; altitude 3 ft. 6 in. The upper cables serve as guards. Some load is transmitted to them through rigid span braces that tie them to the lower cable on which the patrolman walks. These span braces are arranged in pairs (one to each upper guard cable). Pairs of braces are spaced 12 ft. 6 in. apart, center to center, across the entire 225-ft. span.

PATROLMAN'S BRIDGE over White River consists of messenger cable strung in triangular configuration between heavily guyed terminal poles. Span is 225 ft. Bridge is reached via steps on each of the terminal poles



WOOD SPAN BRACES developed for use on later type suspension bridges

The Medora bridge was originally built and is shown with span braces of ⅜-in. round steel rods fastened to the bridge cables with 2-bolt guy clamps. Subsequent bridges will use 2-piece treated wooden span braces that clamp around the bridge cables. It is felt that such wood braces provide a more positive locking of the cables and so contribute to safety of the design.



DESIGN DETAILS of patrolman's suspension bridge

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Tungsten Contact Life Exceeds That of Silver

HARRY C. MILLER
Philadelphia Electric Co.

Tungsten contacts replaced silver contacts on the shunting relays of the vibrating-type voltage regulators on synchronous condensers and frequency changers in two stations of the Philadelphia Electric Co. and greatly in-

creased contact life resulted. Originally silver contacts were installed and, although the operating force supplied supplementary maintenance, frequent renewals were necessary. Optimum benefits of the voltage regulators were obtained only for short periods immediately following the regulator overhauls.

In studying this problem a trial installation was made on one synchronous condenser using one tungsten contact and one silver contact. The polarity reversing switch was so positioned that the tungsten was always at a positive potential. At the end of one year's operation, the wear on the contacts was found to be negligible. At no time during the trial period was the machine capacity reduced because of the regulator contact condition.

As a result of this experience the remaining synchronous condenser voltage regulator shunt relay contacts have been provided with one tungsten and one silver contact. It was found, however that two tungsten contacts operated more satisfactorily on the frequency changers.

The original installations of the tungsten contacts have been in service more than four years and have required no replacements in that period. A marked reduction in maintenance labor has also resulted as well as an improvement in the availability of the machines.

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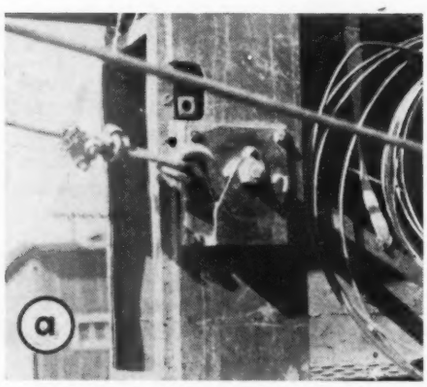
Safety Eye Holds Winch Line Hook

A special safety "eye" for line trucks, that prevents the winch line hook holding the derrick from jumping out accidentally and letting the derrick fall, has been used on the Northwestern Public Service Co. system since the spring of 1945. The safety eye, shown, was developed and built by O. M. Sundberg and Stanley Sickel, Huron, S. D., and described in the "Safety Bulletin" of Middle West Service Co.'s Bureau of Safety, Inc.



SAFETY EYE on back of line truck prevents winch line hook from disengaging accidentally and dropping pole derrick. Hook under tension is shown at (a). To engage or disengage hook (b) it must be turned 180 deg. from normal position

It is made of heavy metal plates in the form of a "U" securely fastened to the frame of the truck. All the strain on the winch line is carried on a steel pin which passes through both the eye plates and the truck frame. A curved metal segment cut from 6-in. pipe is fitted inside the eye, below the pin, so that movement of the hook while engaging the pin is restricted to circular motion.

The circular plate is arranged so that it is impossible for the hook to go on or off the pin except when the winch line is 180 deg. out of its normal position when holding the derrick. The eye is mounted on the back of the truck so that the hook can be engaged by a person standing on the ground. Height of the eye above ground is the same as that of the regular eye with which the truck is normally equipped.

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Boatswain's Chair Is Safe and Easy

Frequently the painting of high surfaces requires a boatswain's chair. The substation department of The Detroit Edison Co. has made this work both comfortable and safe with the chair shown.

It is comfortable because it hangs in a balanced position and is equipped with adjustable back and foot rests, and has a form seat.

It is safe because the occupant is secured in the chair under any condition. A safety belt prevents the man from tipping out sideways. A straddled vertical member prevents the user from sliding out forward.

BOATSWAIN'S CHAIR for painting high surfaces on Detroit Edison system

The assurance and convenience to the painter that result from these features leads to more effective work, F. C. Pohl, Detroit Edison's superintendent of substations, reports.

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Lessons From A Transformer Fire

Protection of critical sections of industrial plants against electric fire hazards was recently emphasized in a study of a representative case by the Inspection Department of the Factory Mutual Fire Insurance Companies. Twenty-two electric melting furnaces were located in a casting shop, the controls being placed in an excavated section below the floor. All regular production transformers had non-flammable coolant. To operate an experimental furnace, two 200-amp., 22-kva., 500-200-volt oil-cooled autotransformers were installed in a power tunnel serving this shop. Connections to the substation and furnace were made by temporary wiring, using 600-volt

wire in conduit wherever available. On a Sunday, while the plant was not operating, but when all furnace controls were set at "Hold" heat, with the oil-cooled transformers delivering about 125 amp., difficulty was experienced in maintaining the proper temperature on one of the furnaces. The power tunnel was found full of smoke; the plant fire brigade was called and the two oil-filled transformers were seen to be on fire. The main switch was pulled and the fire put out in 13 minutes with the aid of fifteen 2.5 gal. and one 40-gal. soda-acid, six 2.5-gal. foam, two 1-gal. vaporizing liquid type and three 10-lb., CO_2 extinguishers. All furnaces except that served by the oil-cooled transformers were reenergized in 30 minutes after discovery of the fire.

The autotransformer equipment, switch panel and wiring were destroyed; insulators for about 100 ft. of three high-line bus bars were ruined; bus bars were warped in places, requiring taking down and cleaning; wiring between capacitors, transformers and selector switches on seven furnace controls was badly burned; lighting fixtures were broken and three asbestos-taped, water-glass-coated, single-phase conductors between controls and furnaces were slightly damaged. Of the twelve furnaces affected by the fire, all but one were ready for operation at melting heat by 1:30 a.m. Monday. Each furnace had a capacity of 1,500 lb. per hr.

The cause was possibly a breakdown in one of the oil-cooled transformers; but the fire emphasized the danger of placing a potential hazard in a critical section of the plant without proper safeguards. The insurance company stated that unless transformers of a dry type or of a type filled with a non-flammable liquid can be used for replacement, transformers should be located well away from other important apparatus, and provision should be made for adequate drainage of any escaping burning oil. Suitable vaporizing liquid type extinguishers were also recommended for installation at each end of the power tunnel.

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Relays Maintain Service To Demand Meter Circuit

V. W. NASS
Supervising Engineer, Meter Testing Division, Commonwealth Edison Co., Chicago, Ill.

In installing demand metering equipment involving an electric clock and a printing type of demand meter, it is important to energize this circuit from a source that will not be interrupted every time the main power service switch is opened due to unintentional outages or for maintenance work. This practice will eliminate service calls to reset the clock and the tape or chart on the demand meter.

In the case of low tension metering installations, standard practice in the Commonwealth Edison Company is to connect the wires supplying the demand meter circuit to the line side of the service switch. In the case of high tension installations, this circuit is energized from either an auxiliary standard lighting source or from a small transformer that supplies vault lighting. By following these practices, interruptions to the clock and demand meter are minimized and consequently service calls are greatly reduced.

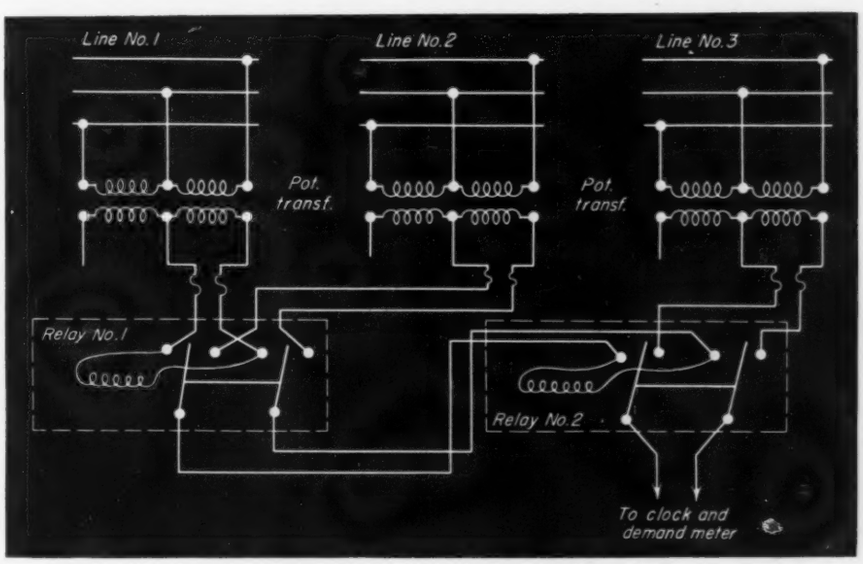
Recently we had a high tension metering installation where the only source available to energize the demand circuit, was from the secondary of the potential transformers. This customer was supplied by three incoming lines feeding into a ring bus, with watthour meters and instrument transformers on each line. Demand is totalized through a totalizing relay. When under consideration, it was evident that if interruptions to the clock and demand meter were to be minimized, some form of throw-over switch would have to be used.

Operation of Relays

The problem was solved by using relays wired as shown.

In this method, the holding coil of relay No. 1 was wired to a potential transformer energized from line No. 1. As long as line No. 1 remains alive, the demand circuit is energized from this line, through relay No. 2. When line No. 1 is opened, the movable contacts of relay No. 1 fall back and make contact with transformer leads energized from line No. 2, which, through the holding coil action of relay No. 2, supply the demand circuit. If both lines 1 and 2 are open, the movable contacts in relay No. 2 fall back and contact leads connected to a potential transformer are energized from line No. 3. In this way the demand meter circuit has a feed as long as any one of the three lines is alive.

Substantial relays with wide break contacts were used to eliminate any possibility of cross contacting and feed back. The scheme has functioned successfully and reduced interruptions to the clock and demand meter service on this installation to a minimum.



RELAYS PREVENT INTERRUPTIONS of service to clock and demand meter of high tension metering installation by connecting demand circuit to lines 1, 2 and 3 successively in event of loss of voltage. Scheme reduces service calls to reset clock and meter tape or chart. Both relays have wide break contacts

Tower Arms Relocated, Dancing Conflict Voided

F. H. LEGGE
Transmission Construction Engineer
Electric Distribution Dept.,
Public Service Electric & Gas Co., Newark, N. J.

A method to stop conflict of dancing conductors on double-circuit steel tower transmission lines is to increase the vertical and horizontal spacing of the conductors by relocating the two lower crossarms. That was the procedure which Public Service Electric and Gas Co., Newark, N. J., used for 12 miles of a 132-kv. double-circuit transmission line from a generating station to a switching station.

The 80 towers on this line are the bolted type, have all four sides equal and range in height from 120 to 260 feet. Each tower has two ground wires attached to the ends of a 30-ft. long ground wire crossarm at the top of the tower. Each conductor crossarm is diamond shaped and the axes intersect the mid-points of the respective sides of the tower. At the extreme ends of the long axis the insulator strings are attached. On the suspension towers the conductors of each circuit are carried by strings of nine insulators and on dead-end towers each string has eleven insulators.

When originally installed, the top, middle, and bottom conductor crossarms had a length of 24, 30 and 24 ft. respectively. By this arrangement the middle conductor extended 3 ft. beyond the vertical plane of the top and bottom conductors. The conductor crossarms were 13 ft. apart vertically, the lowest crossarm being at the bend line of the tower. The top conductor crossarm is 8 ft. below the ground wire crossarm on suspension towers and 13 ft. below the ground wire crossarm on dead-end towers.

For the new conductor configuration the ground wire and top conductor crossarms were not altered and remained in the same locations.

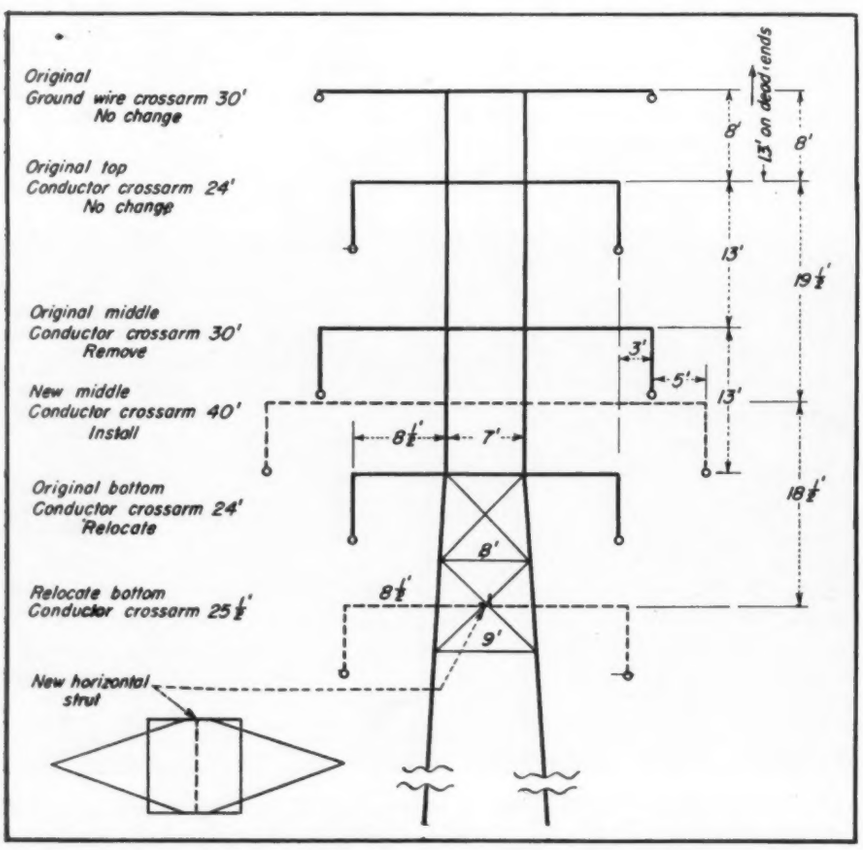
The middle conductor crossarm was lengthened to 40 ft. and lowered 6½ ft. from its original position and is now 19½ ft. below the top conductor crossarm. Because of its greatest length, the middle crossarm is a complete new member.

The original bottom crossarm was moved 12 ft. down on the tower to a new position. It is now 18½ ft. below the new middle crossarm.

Because of the flare or widening of the tower, the bottom crossarm when lowered was lengthened from 24 ft. to 25½ ft., the butt ends of the crossarm members being placed farther apart. This made it necessary to reinforce the tower at this location with a horizontal strut between the angles supporting the butt ends of the crossarms.

It required approximately 130 man-hours to rearrange the middle and bottom conductors on each of the 65 suspension towers and approximately 250 man-hours were required on each of the 15 dead-end towers.

The work was done on one side of the tower at a time while the circuit on the other side was energized.



SKETCH shows original and new location of middle and bottom conductor crossarms

•

Treatment Gives Rope High Dielectric Strength

Rope to which high dielectric strength has been imparted by treatment of individual strands during manufacture and before weaving has recently been introduced for electrical industry use. The treatment is said to leave tensile strength of the rope unimpaired.

Dry samples of the rope have withstood 100,000 volts per foot for 5 minutes without heating, while wet samples that were soaked in tap water for three hours withstood 50,000 volts for the same test interval, according to James R. Kearney Corp., St. Louis. Wet samples showed ohmic resistance of the treated rope to be 20 or 30 times more than untreated samples.

Abrasion resistance of the rope appears to be improved by the treatment, it is said, treated samples having withstood 100 percent more cycles of operation than untreated Manila rope of the same size.

Moisture tests indicate that untreated rope absorbs five or more times as much water and swells more than treated rope which, it is claimed, also dries faster. Mildew and dry rot are said to be prevented by the treatment.

The preserving compound used in the treatment does not contain ingredients that are injurious to the skin. It is reportedly free of creosote and other coal tar derivatives, gum, resin, starch, wax, casein, oxidizing and vegetable oils. Further than this, however, its content is not disclosed.

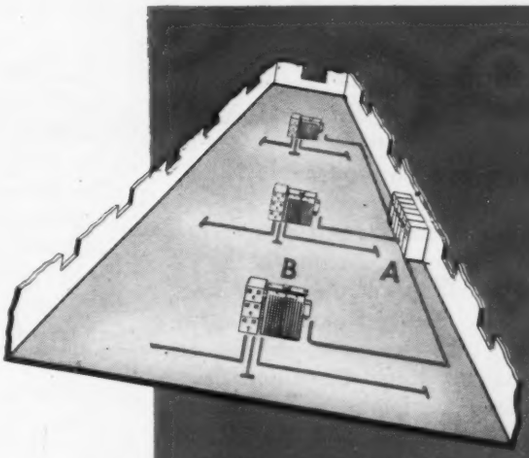
G-E dry-type unit substations are styled to meet 1946 requirements for neatness and clean-cut appearance in your plant equipment-layout. Their design simplicity lends itself to ease of location and facility of installation. Their light weight reduces structural problems.

Users who prefer dry-type equipment will find these unit substations at the top of their class in their ability to handle overloads. For, the transformer sections of G-E dry-type unit substations are designed to meet AIEE Standards No. 1 for Class B insulation, with *130 C maximum hot spot temperature* in a maximum ambient of 40 C. They also meet ASA Standards C-57.1, which limit the observable temperature rise to 80 C.

These unit substations have factory-matched switchgear —that is, the interrupting capacity of the switchgear section is matched, electrically, mechanically, and thermally, with transformer characteristics.

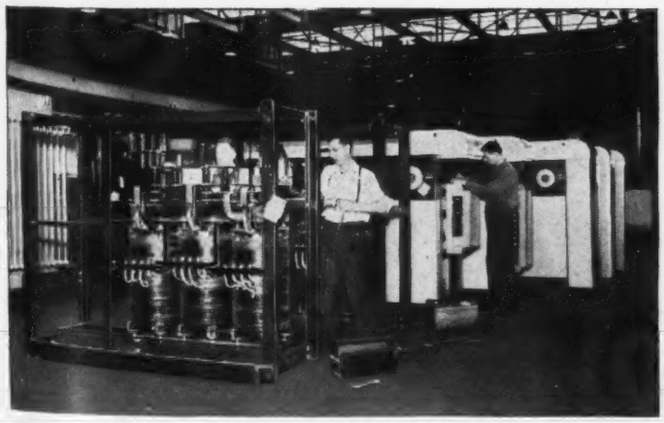
G-E dry-type unit substations are repetitively manufactured. This is a feature adding to their flexibility, for as load requirements change, expansion is met by the addition of similarly matched units, block by block. Thus, a planned efficient load-center power distribution system is always in operation in your plant. G-E dry-type unit substations are available in ratings up to 2000 kva, 15,000 volts.

Ask for bulletins GEA-3592A and GEA-3714B. Call your nearest G-E representative or write to *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

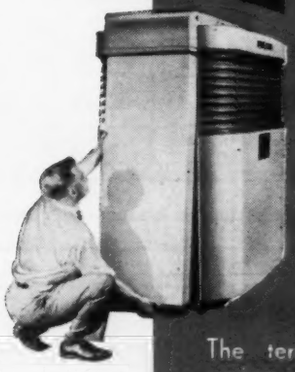


In a modern load-center distribution system, power is distributed from metal-clad switchgear (A) at relatively high voltage (2.4 to 13.2 kv) to load-center unit substations (B) located near the centers of electrical load areas. There it is stepped down to utilization voltage (below 600 volts) and distributed to the load through short secondary feeders.

UNIT SUBSTATIONS



G-E dry-type unit substations have been supplied in quantity since early in the war-construction period, and sizes and types to meet individual load conditions can now be ordered "right out of the catalog."



The terminal compartment casing extends down the entire side of the substation, facilitating cable entrance connections. The unit can be moved into place after conduit and cable have been made up. On vital conversion jobs, this convenience feature will save many precious hours.

GENERAL ELECTRIC

321-44-5900

Distribution Staff Duties Summarized*

Maintenance Supervisor

On this system the proper operation of the distribution circuits is the direct responsibility of the maintenance supervisor. This also embraces operation and maintenance of substations, including any automatic sectionalizing or transfer equipment under departmental jurisdiction, and the maintenance of such apparatus in operative condition, including cleaning, inspecting, testing and required records. Detection of overloads on any part of the system is included and this applies to electrical apparatus, transformers, cable, wire, fuses, cutout boxes, etc., with necessary tests of both overload and voltage conditions.

In the case of protracted and unrelieved overloads, these are reported to the superintendent of distribution after a reasonable time for correction, and unsatisfactory voltage conditions are reported to the maintenance engineer by the supervisor.

The maintenance supervisor is responsible for the repair of all used transformers, and for seeing that a sufficient number are kept in stock ready for service. He keeps a record of all transformers in service (see illustration). Under him come the proper periodic inspection and testing of transformers, oil switches, oil fuses, capacitors, voltage regulators and other equipment allied to power distribution, with records of all such inspections and tests.

Maintenance work under this supervisor applies, including testing, to 2,300-volt lightning arresters; storage batteries (except for motor vehicles); maintenance of installations of automatic transfer equipment in connection with duplicate service to important customers (including inspection and records); maintenance of an automatic fire alarm system in the major service building; phase balance readings and records made annually; handling radio interference reports; arrangement with important customers for temporary interruption of service when required; adjustment of contact-making voltmeters and line drop compensators on all circuits including those in stations operated by the production department; inspection for quality of all substation equipment for sale, and for sampling, testing, handling, storing and filtering, as well as stocking liquid insulation.

Operating check-ups and special tasks handled by the maintenance supervisor will be outlined in ensuing issues.

*One of a series of presentations covering the essential duties of distribution department officials in an electric utility company serving between 50,000 and 75,000 meters. First installment in ELECTRICAL WORLD, October 13, 1945, page 106.

Block 165 — Cot. 332 — FORM 130-4 IM-11-37

TRANSFORMER LOAD

PLATE MAP NO. 9-B LOCATION Pole #4 Rr. #27 St,

CONNECTION 3-W INSTALLED 12-15-44 KVA 37.5 NO. 3866

V. PRI. 2400-4160Y / 2500-4330Y V. SEC. 120-240/125-250

Thermotel

TRANSFORMER LOAD TEST

DATE	TESTED BY	TYPE METER	% LOAD	PRIMARY	SECONDARY LEFT	SECONDARY RIGHT	DATE	TESTED BY	TYPE METER	% LOAD	PRIMARY	SECONDARY LEFT	SECONDARY RIGHT
11-20-35	Deg.	Mex. Ind.	70%		8.5 Kva	8.2 kv-a.							
8-31-36	C.S.H.	Therm.	90%										
9-17-37	"	"	93%										
10-4-37	Deg.	Mex. Ind.	80%	17.2 Kva									
12-8-39	Hilton	Mex. Ind.	85%		8.5Kv-a.	7.35 Kv-a.							
9-21-40	C.S.H.	Therm.	95%										
10-21-40	Deg.	"	80%										
12-31-40	C.S.H.	Mex. Ind.	85%		12.4Kv-a.	11.05 Kv-a.							
10-2-41	C.S.H.	Therm.	100%										
10-8-42	"	"	90%										
12-21-42	"	Mex. Ind.	60%		11.03Kv-a.	13.80 Kv-a.							
10-4-43	"	Therm.	90%										
11-26-43	A.M.K.	Mex. Ind.	80%		10.3Kv-a.	8.6 Kv-a.							
10-10-44	C.S.H.	Therm.	105%										

CARD RECORD (5-in. x 8-in.) of transformer loading, tests and inspections

RECORD OF TRANSFORMER INSPECTIONS

INSPECTED BY	HOW INSTALLED	WATER IN OIL	INCHES OIL ADDED	CONDITION OF INTERIOR	CONDITION OF GASKET	CONDITION OF LEADS	CONDITION OF BUSHINGS	DATE	REMARKS
Deg.	Pole Hung	No	--	Good	Good	Good	Good	4-29-37	60A. Exp. #20 C.W.

VOLTAGE TESTS

AT TRANSFORMER DAY TIME	AT TRANSFORMER DAY VOLTS	AT TRANSFORMER NIGHT TIME	AT TRANSFORMER NIGHT VOLTS	END OF SECONDARY DAY TIME	END OF SECONDARY DAY VOLTS	END OF SECONDARY NIGHT TIME	END OF SECONDARY NIGHT VOLTS	END OF SECONDARY DAY TIME	END OF SECONDARY DAY VOLTS	END OF SECONDARY NIGHT TIME	END OF SECONDARY NIGHT VOLTS	DATE	TESTED BY
9:30	115	6:40	117	9:40	115	7:00	115	9:20	115	-	-	2-4-37	Hanson
10:25	117	7:15	118.6	10:40	116.6	7:05	118.2	10:15	116.2	-	-	10-21-37	W. Gilbert

27 Dover — 65 Dover St. — 220 — St. Cor. — St.

RECORD OF PREVIOUS TRANSFORMERS

DATE INSTALLED	COMPANY NO	SIZE K.V.A.	DATE REMOVED	DATE INSTALLED	COMPANY NO.	SIZE K.V.A.	DATE REMOVED
10-27-24	2349	10	2-16-32				
2-16-32	3323	25	12-15-44				

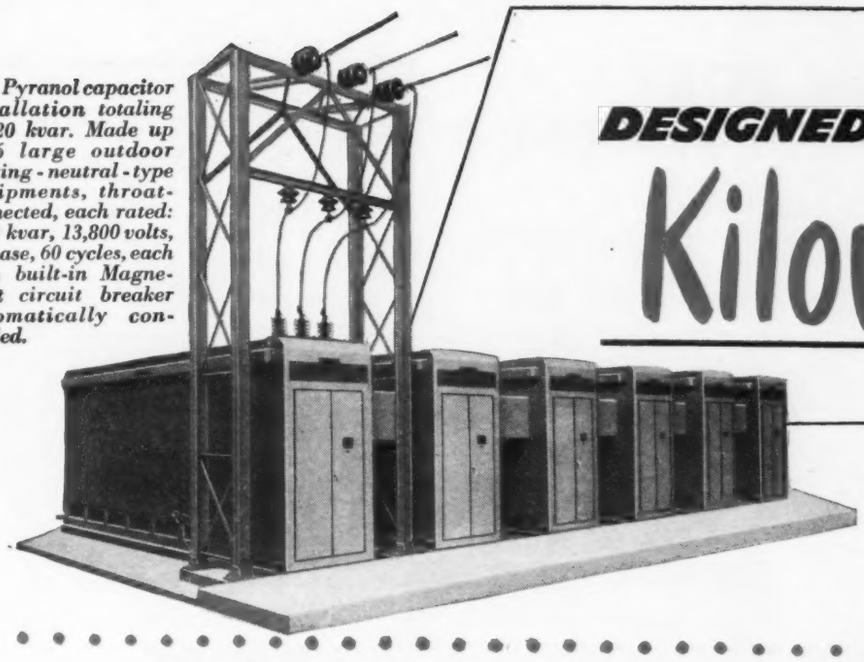
Germans Achieve Synthetic Mica

Development of an improved process for making synthetic mica in Germany was assigned to KWI Silicat Forschung of Berlin/Dahlem because of a shortage of natural mica. Investigation by U. S. Army officers discloses that the best composition is as follows, because it gives a product as good as natural mica and with the same cleavage characteristics:

Material	Percent by Weight
SiO_2	35–39
$(Al, Fe, Cr^2, V)_2O_3$	11–12
$(Mg, Fe, Mn, Zn^2)O$	29–35
$(Na, K)_2SiF_6$	11–13
$(Na, K)^2F$	6–7

Basic means for getting larger blocks of mica was carefully to control the cooling of the melt, especially in the critical range 1270-1230C and the introduction of a magnetic field at right angles to the vertical axis of the crucible. Development had been entirely confined to laboratory-scale operations. Using 100-200-gram melts, the best samples gave blocks 3½-in. in size; blocks 6-12-in. in size would be commercially practicable. One ton batches are believed entirely feasible for commercial operation.

High quality technical raw materials were found sufficiently pure. Graphite crucibles manifested no sticking; those used in the laboratory had 2-3 mm. walls; a one-ton crucible should have 5-8 mm. walls. The slower the cooling in the 1270-1230C range, the larger the crystals. The magnetic field is needed as a supplement to controlled cooling to get large flat sheets; the field was of 13-gauss intensity.



G-E Pyranol capacitor installation totaling 15,120 kvar. Made up of 6 large outdoor floating-neutral-type equipments, throat-connected, each rated: 2520 kvar, 13,800 volts, 3-phase, 60 cycles, each with built-in Magne-blast circuit breaker automatically controlled.

DESIGNED TO ADD Kilovars—

Without adding Cares!

THE EXTERNAL STYLING *of these G-E capacitors does a lot more than add to their appearance. Compact arrangement saves space. The enclosures fend off wind and weather. Elimination of much overhead gear cuts installation and maintenance costs.*

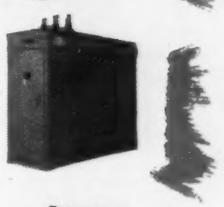
MORE than that, there is extra operating benefit to be gained wherever G-E Pyranol capacitors are used—especially if factory-matched circuit switching components are included in the units. Their compact, "all-in-one" cabinet construction includes built-in safety features and equipment protection.

Because they are so adaptable, G-E Pyranol capacitors can help you solve future as well as present load problems. A large bank of capacitor equipments installed today to meet heavy localized demand for reactive kva can later be split into smaller banks for reinforcing other parts of your system if needed.

The large range of unit sizes of G-E Pyranol capacitors which may be had also adds to the desirability of their use. They may be obtained in ratings ranging from 230 to 13,800 volts, 45 to 2520 kvar, and with or without circuit breakers. Smaller units are available for all types of indoor and outdoor use, including pole types, and enclosed units for weather-tight service.

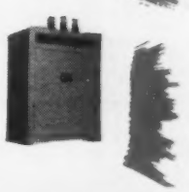
For additional information pertaining to all sizes of G-E capacitor units, call your nearest G-E representative, or write to *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

***Indoor** 230 volts, 180 to 630 kvar. 460 and 575 volts, 360 to 1260 kvar*

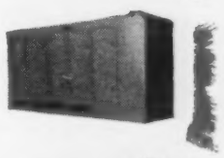


***Outdoor** 230 volts, 135 to 630 kvar. 460 and 575 volts, 270 to 1260 kvar*

***Indoor** 2400/4160 Y volts, 45 to 180 kvar. 4800 and 7200 volts, 90 and 180 kvar*



***Pole type** 2400/4160 Y volts, 45 to 180 kvar*



***Indoor** 2400/13,800 volts, 360 to 2520 kvar*

***Outdoor** 2400/13,800 volts, 360 to 2520 kvar*

GENERAL ELECTRIC

407-99

RIGGING GUIDE FOR HOISTING TRANSFORMERS

I—Snatch Block Method; Load Line Slope 2:1‡

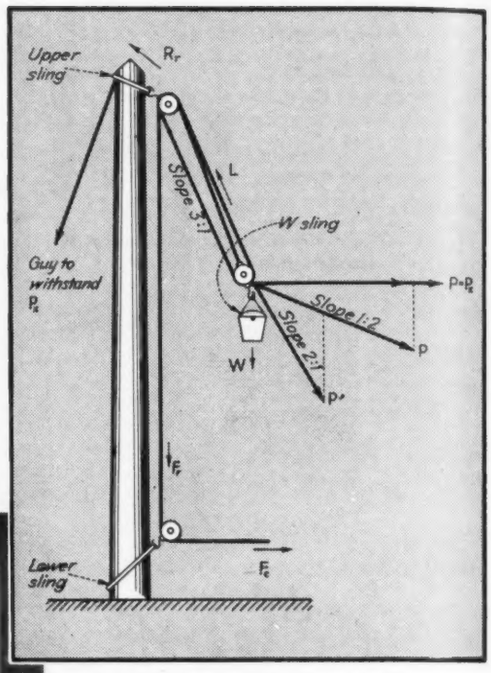
Accompanying chart gives reactions encountered and equipment required in hoisting transformers of various sizes by the simple pull line-snatch block method. Values given are equally safe for either the raising or lowering operation

ARTHUR W. CHEWNING, Estimating and Operating Division, Overhead Lines Department, Detroit Edison Co., Detroit, Mich.

Table summarizes result of a study of rigging requirements by the overhead lines department in cooperation with the company research department.

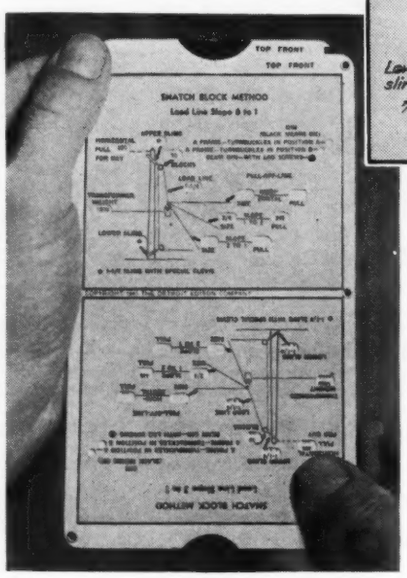
Strength values used for tackle blocks, slings and pull-off lines were established by tests conducted by the company research department. Certain blocks were not tested however because they were critical war tools and it was not considered wise to destroy them by test. Instead a safety factor of five was applied to the manufacturers rating. Safety factor for tested blocks was three. Rope strengths were obtained from War Emergency Service Book No. 4, Plymouth Cordage Co., and a safety factor of five used.

Values in this and similar tables for other rigging schemes have been incorporated into a slide rule (shown) for quick reference in the field. Copyright to this slide rule is owned by Detroit Edison Co.



ABOVE

Snatch Block Method. F_c = pull exerted by capstan, F_r = fall line pull. L = pull on load line. P = pull on pull-off line. P_x = horizontal component of P. R_r = becket block reaction



LEFT

Slide rule developed for field use; front side (shown) for snatch block method, reverse side for three-sheave block method

Rigging Data for Hoisting Transformers—Assumed Load Line Slope 3:1

W lb.	L lb.	F_r (1.18L) lb.	F_c (1.18F_r) lb.	R_r (L+F_r) lb.	P lb.	P_x lb.	Blocks Size, in. M	Blocks Size, in. S	W Sling, in. M	W Sling, in. S	Rope Size, in. M	Rope Size, in. S	P Line, in. M	P Line, in. S	Upper Sling, in. M	Upper Sling, in. S	Lower Sling, in. M	Lower Sling, in. S
Pull-off Line Horizontal, Slope = 0																		
100	105	123.5	146	228.5	33.4	33.4												
200	210	247.0	292	457	66.8	66.8	7	7	1/2	1/2	1/2	1/2	1/4	3/8	1/2	1/2	1/2	1/2
400	420	494.0	582	914	133.6	133.6	7	7	1/2	3/4	3/4	3/4	3/8	1/2	3/4	3/4	3/4	3/4
600	630	741.0	875	1371	200.4	200.4	7	8	3/4	1	3/4	1	1/2	1/2	3/4	3/4	3/4	1
800	840	988	1165	1828	267.2	267.2	8	8	3/4	1	1	1	1/2	3/4	1	1	1	1
1000	1050	1235	1460	2285	334.0	334.0	8	10	1	1 1/4	1	1 1/4	3/4	3/4	1	1	1	1
1200	1260	1482	1750	2742	400.8	400.8	10	10	1 1/4	1 1/4	1 1/4	1 1/4	3/4	3/4	1	1 1/4	1	1 1/4
1400	1470	1729	2040	3199	467.6	467.6	10	10	1 1/4	6 M	1 1/4	1 1/4	3/4	3/4	1 1/4	†	1 1/4	†
1600	1680	1976	2270	3656	534.4	534.4	10		1 1/4	6 M	1 1/4		3/4	1	*	†	1 1/4	†
1800	1890	2223	2625	4113	601.2	601.2	10			6 M	1 1/4		3/4	1	*	†		
Pull-off Line Slope 1:2																		
100	126	148	175	274	44.7	40.0												
200	252	296	350	548	89.4	80	7	7	1/2	1/2	1/2	1/2	3/8	3/8	1/2	1/2	1/2	1/2
400	504	592	700	1096	178.8	160	7	7	1/2	3/4	3/4	3/4	1/2	1/2	3/4	1	3/4	1
600	756	888	1050	1644	268.2	240	7	8	3/4	1	3/4	1	1/2	3/4	1	1	1	1
800	1008	1184	1400	2192	357.6	320	8	8	3/4	1	1	1	3/4	3/4	1	1	1	1
1000	1260	1480	1750	2740	447.0	400	8	10	1	1 1/4	1	1 1/4	3/4	3/4	1	†	1	1 1/4
1200	1512	1776	2100	3288	536.4	480	10	10	1 1/4	1 1/4	1 1/4	1 1/4	3/4	1	1 1/4	†	1 1/4	†
1400	1764	2072	2450	3836	625.8	560	10		1 1/4	6 M	1 1/4		3/4	1	*	†	*	†
1600	2016	2368	2795	4384	715.2	640			1 1/4	6 M			1	1	*			
Pull-off Line Slope 2:1																		
100	316	372	439	688	224	100												
200	632	744	878	1376	448	200	7	8	1/2	1/2	3/4	1	3/4	3/4	3/4	3/4	3/4	1
400	1264	1488	1755	2752	896	400	8	10	1/2	3/4	1	1 1/4	1	1 1/4	1	1 1/4	1	1 1/4
600	1896	2232	2630	4128	1344	600	10		3/4	1	1 1/4		1 1/4		*	†	*	†

*1 1/4 in. M sling with special clevis †1 1/4 in. S sling with special clevis. S—Sisal rope M—Manila rope.

‡ Three-sheave block method will be outlined in a subsequent issue.

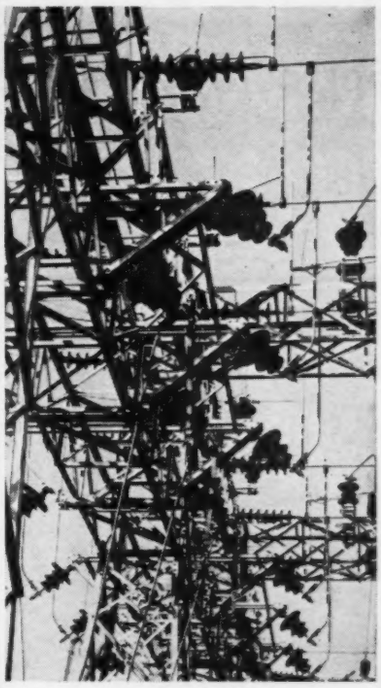
a time when you

GOOD IT IS

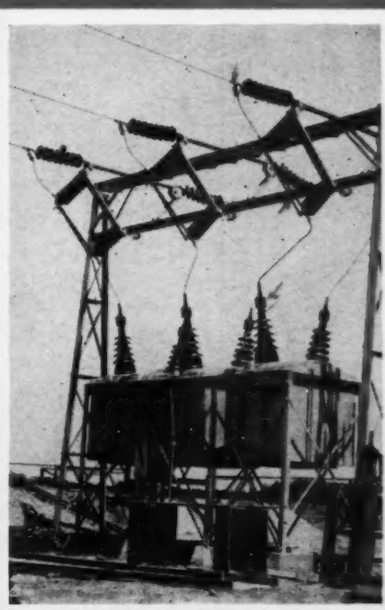
When there was a choice of any new car, the question might have been asked, "How good is it?" But, thousands of miles ago, that question was answered. Here, we have a direct parallel in insulators. When new, they look alike, specify alike and, outwardly, *are* alike. But, the satisfied owner of the old car, like the long-time user of an O-B insulator, has finally forgotten to ask himself the question, "How good is it?" He knows!

Remember, when you buy new insulators, *they don't stay new!* The characteristics of a new insulator don't mean a thing if they deteriorate with the passage of time. The important thing about any O-B insulator and equally, O-B hardware, is its ability to retain its newness. When you insulate with O-B, the time will finally come when you forget the question, "How good is it?" You'll know! The accompanying photos are evidence of the truth of this statement.

2645-H



These O-B switch insulators have seen well over 20 years of active service without trouble.



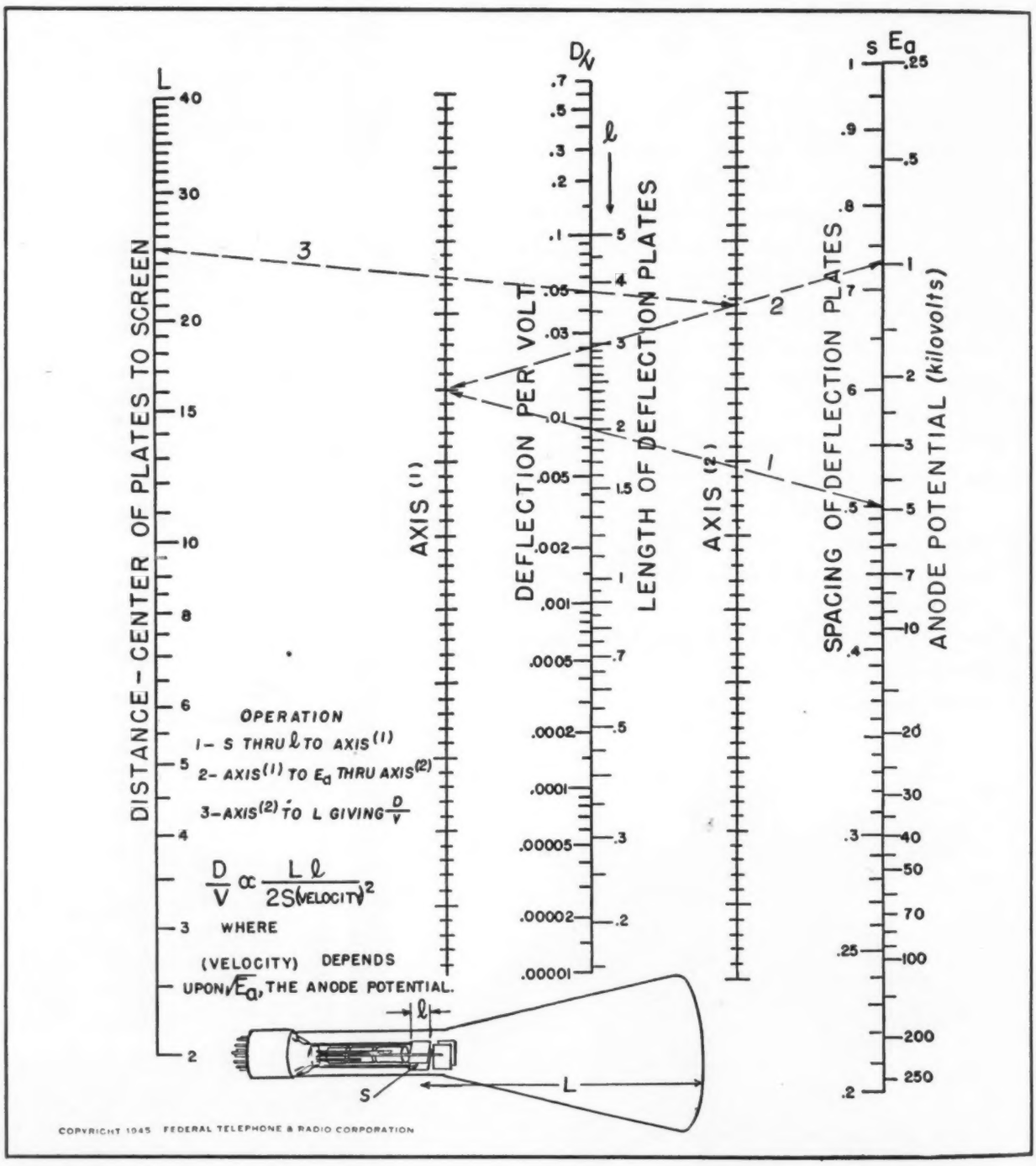
Twenty-six years ago, these O-B oil-filled bushings were put on 110 Kv. service and have never required other than routine attention.

Deflection Sensitivity of Cathode Ray Tube Electrostatic Deflection

(with corrections for velocity of electrons)

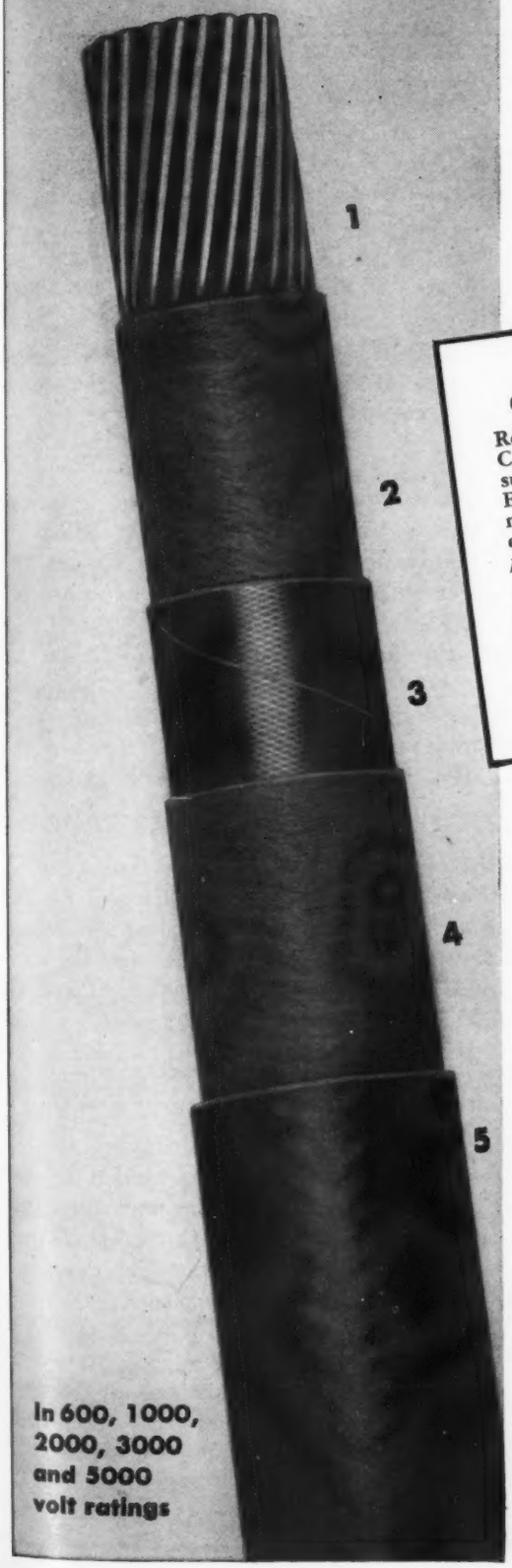
N. MARCHAND, Engineer,

Federal Telephone and Radio Corp., New York



The electrostatic deflection sensitivity of a cathode ray tube, for a given anode potential (E_a), depends on spacing (S) and length (l) of deflection plates, and their distance (L) to the screen. A line from (l) and (S) scales is extended to axis (1). From latter intersection a second line is drawn to (E_a) scale intersecting axis (2). From this point, a third line is drawn through (L) and extended to intersect D/V scale at left. (S), (l), (L) and (D) may all be in any convenient system of dimensions.

Where Heat and Fumes are a problem



In 600, 1000, 2000, 3000 and 5000 volt ratings

ROCKBESTOS A.V.C.

Gives Trouble-Free Performance

THIS PERMANENTLY INSULATED CONSTRUCTION GIVES LASTING SERVICE UNDER SEVERE CONDITIONS

Rockbestos A.V.C. 600 Volt Power Cable to the left, and similarly insulated Motor Lead Cable (Nat. Elec. Code Type AVA) have a maximum operating temperature of 110° C. (230° F.) and this *permanent* insulation:

1. The conductor is perfectly and permanently centered in helically applied insulation.
2. Felted asbestos insulation, impregnated with heat, flame and moisture resisting compounds, will withstand conductor-heating overloads and won't bake brittle or burn.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance.
4. Impregnated asbestos insulation that won't dry out, crack, flow, rot or burn.
5. An impregnated asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

One of 125 constructions developed for severe operating conditions by Rockbestos.

If you are increasing your generating capacity or planning wiring projects . . . insure against premature wire-failure in power, control and lighting circuits exposed to high temperature or corrosive fumes by installing *permanently insulated* Rockbestos A.V.C.

These heat and flame resistant wires and cables have an *impregnated asbestos insulation* that takes the withering heat of 230° F. without baking brittle, cracking or flowing. It won't rot or swell under exposure to sulphurous corrosive fumes, oil or grease. It won't burn. And it gives you greater current carrying capacity.

The same operation protecting characteristics are built into every Rockbestos designed construction—single or multi-conductor plain, lead sheathed or armored Power Cables in AWG and CM sizes, Rheostat Cable, Secondary Network Cable, Vault Cable, Multi-Conductor Control Cables and many others. For recommendations, quotations or a catalog write to:

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126 Nicoll St., New Haven 4, Conn.

ROCKBESTOS A.V.C.

The Wire with ROCKBESTOS Permanent Insulation

NEW YORK BUFFALO CLEVELAND CHICAGO PITTSBURGH ST. LOUIS
LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.

HOW TO SERVICE HAND FIRE EXTINGUISHERS

Procedures for servicing six types of manually operated portable fire extinguishers as outlined by Safety Research Institute, Inc., New York, N. Y.

Hand fire extinguishers must be kept ready for instant use or they may fail to operate properly when needed. To maintain them in good working order, they must be inspected frequently, refilled immediately after use, and thoroughly serviced at least once a year.

The annual servicing may be carried on throughout the year by experienced men, who also take care of recharging. Inexperienced men should be supervised. In no case should so many extinguishers be removed for servicing at the same time as to leave any area without protection.

Soda acid and foam extinguishers must be recharged annually, if they have not been used and refilled in the meantime. Other types are recharged only after use. The tag attached to each extinguisher should show the last date of recharging or annual servicing. Only replacement parts or recharging materials made by the manufacturer of the extinguisher being serviced should be used.

Servicing procedure for each type follows:

VAPORIZING LIQUID

Test the action by pumping some of the contents into a clean, dry container, and return the discharged liquid. In the case of the pump-gun types, add more liquid, if necessary, to bring the level to within half an inch of the top. In servicing the stored pressure type, bring the liquid to the proper level and replenish the air pressure.

Never recharge a vaporizing liquid extinguisher with ordinary carbon tetrachloride or use water to test operation, as either will cause corrosion. Do not lubricate any part of the extinguisher.

SODA ACID

Be sure the nozzle opening is clear; then invert the extinguisher and discharge the contents. Unscrew the head and examine the gasket, which should be replaced if it is damaged or badly worn. Remove the cage containing the acid bottle, putting aside the stopple for later replacement. Make sure all the extinguisher parts are kept together so that they may later be returned to their respective units.

Rinse the extinguisher shell thoroughly with warm water, draining it through the hose. Open clogged holes in the hose strainer with a piece of wire. Replace the hose and nozzle, if badly worn or damaged.

Dissolve the dry chemical in lukewarm water, according to directions on the recharge package. Pour the solution into the extinguisher shell, and bring to the filling mark by adding water. Remove the cork from the new acid bottle and replace it with the stopple from the old bottle. Replace bottle and cage in the extinguisher neck. (If any acid spills on the skin or clothing, wash it off with water.) Rub a little vaseline on the shell threads and replace the head, using only hand power. Be sure that the gasket fits snugly against the shell neck.

Caution: If the extinguisher looks badly dented, or the seams appear weakened, do not discharge. Instead, remove the head and pour out the contents. Return to the manufacturer or his agent for repair.

FOAM

As in the case of the soda acid, discharge by inverting. Remove the head and lift out the inner tank. Rinse the extinguisher thoroughly, draining water out through the hose. Dissolve the charging material according to instructions on the packages, using hot water for the "A" charge and lukewarm water for the "B" charge. Pour solution "A" into the inner cylinder and solution "B" into the outer tank, bringing both up to the filling marks by adding water. Replace the stopple on the inner tank and return it to the extinguisher shell. Replace the head, as for the soda acid.

LOADED STREAM AND GAS CARTRIDGE

Since these types operate by gas released from a carbon dioxide cartridge, they should not be discharged for the annual servicing. Remove the head and gasket and inspect parts as outlined under the soda acid. Remove the cartridge and weigh on an accurate scale. A loss of half an ounce or more indicates leakage and a new cartridge should be inserted. If necessary, add water to bring the liquid in the tank up to the filling mark. Then replace the head.

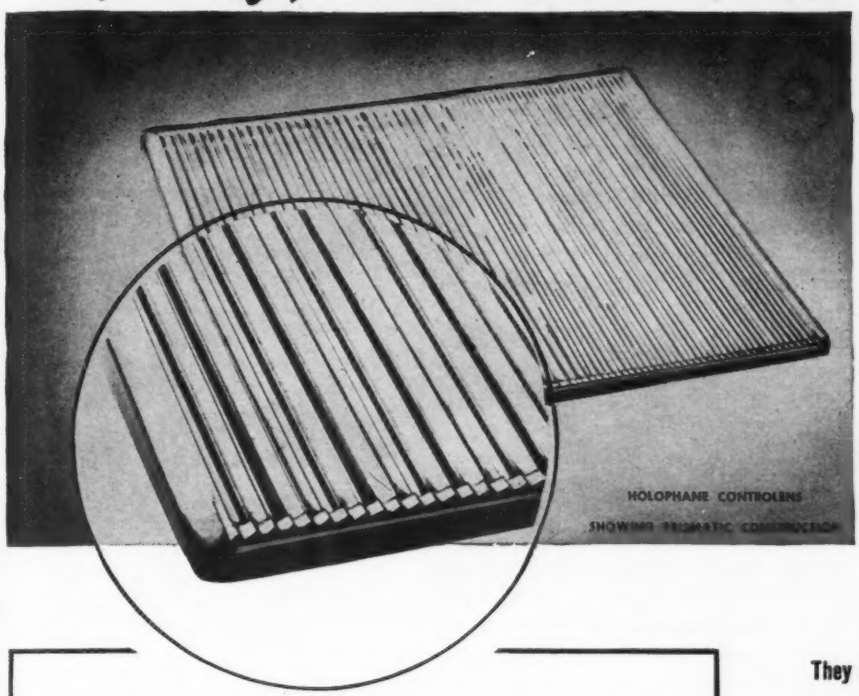
CARBON DIOXIDE

Examine hose and horn for defects and see that the seal on the operating valve is intact. Weigh the unit. If there is a loss of weight, the distinguisher should be recharged. Recharging service is offered by the extinguisher manufacturer or his agents or by carbonic gas plants.

PUMP TANK

Test by operating the pump several times, discharging the solution back into the extinguisher tank. A drop of thin lubricating oil may be placed on the piston rod packing. Bring up to the filling mark by adding water.

Specify *CONTROLESCENT LUMINAIRES



* Equipped with Holophane Controlenses . . .

For Fluorescent Installations that are PLANNED Right and STAY Right

Controlescent Luminaires may be obtained through these authorized manufacturers:

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New York 17, N. Y.

Condi-Lite Corp.
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Day-Brite Lighting Inc.
5401 Bulwer Ave.
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The Frink Corp.
23-10 Bridge Plaza North
Long Island City 1, N. Y.

Gotham Lighting Corp.
548 W. 22nd St.
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Grand Rapids Store Equip. Co.
Grand Rapids
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Gruber Brothers
72 Spring St.
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Hub Electric Corp.
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Litecontrol Corp.
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Summerour and Devine, Inc.
113 W. 17th St.
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2200 Scranton Road
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They are Planned Right because: (A) Controlescent Luminaires provide flexible illumination through three distinct light distributions; since these lenses have similar appearance there is complete architectural conformity . . . (B) Prismatic Control concentrates down light on useful areas while it dispels troublesome glare . . . (C) The output efficiency of Prismatic Glass can be equalled with no other medium.

They Stay Right because Prismatic Glass is: (1) Crystal clear, *it will not discolor . . .* (2) It is water repellent, *and stays that way . . .* (3) Scratch resistant, *impervious to abrasion . . .* (4) Will not warp, *even at extremely high temperatures.*

HOLOPHANE COMPANY, INC. . . . *Lighting Authorities Since 1898*

342 MADISON AVENUE, NEW YORK 17 • Holophane Co., Ltd., 385 Yonge St., Toronto, Can.

Positioning Fixture For Large Weldments

Need of a special fixture to position the welding of large weldments at the Chain Belt Company was fulfilled by Ray F. Lein, designer, and D. F. Lynch, welding technician, who designed and built a set-up using a standard 6,000-lb. capacity positioner, electrically driven, set on a fabricated adapter frame and worked in conjunction with a tailstock. Following description is adapted from information supplied in a contest held by the *Hobart Arc Welding News.*

The tailstock is constructed almost entirely of welded fabrication and consists of a base framework with machined surface runners and an A-frame pedestal with machined base runners. These two component parts are held together with a heavy cross clamp and built-in adjusting screw for setting the unit to close measurements.

The A-frame pedestal carries a face plate with shaft, bearings, etc., aligned with the face plate on the 6,000-lb. positioner. Face pads and solid anchor tubes are set into the floor to tie down the tailstock unit. When the set-up is to be used for welding products of extreme differences in length, the entire framework of the tailstock is shifted to the proper anchor points and locked in place. The final adjustments are then made with the handwheel adjusting screw.

An important feature of the tailstock is the well built set of steps up either side of the A-frame with an accompanying guide rail which permits the operator to mount the weldment safely.

Another unique feature is the design of the adapter brackets, one of each being fastened to the face plate on the positioner and tailstock. An assortment of adapters is available for fastening the parts to the face plates. Welding designs call for sections varying in width from 2 ft. 10 in. to 10 ft. 10 in. and in lengths up to 15 ft. The 6,000-lb. standard positioner at the opposite end from the tailstock can be used separately when smaller weldments do not require the use of the tailstock.

Numerous products have been welded in this set-up, such as awkward-to-handle frames, hoppers, casings, and large buckets in a wide range of sizes. Results have shown that in using this design, fabricating departments are able to control welding procedure to much better advantage, good results being obtained in lower unit cost with safer handling and the ability to obtain downhand position welds with better uniformity in overall sizes of large weldments.

•

Tree Interruptions

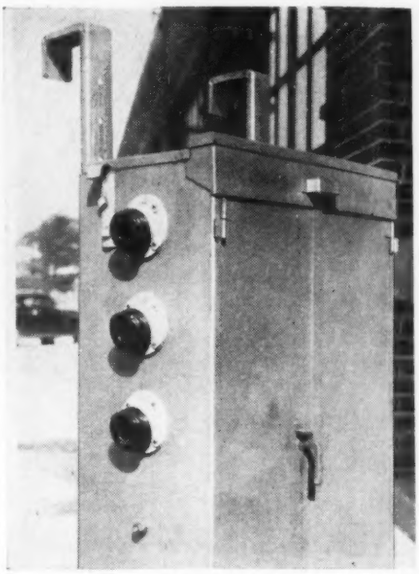
In a recent year the distribution interruption record of an Eastern utility was 5,501 outages on primaries and secondaries. Of these there were 115 due directly to the exposure to 256,000 trees. Primaries were interrupted 12 times and the secondaries 103 times because of proximity to the trees.

Wind and inept tree-felling accounted for 422 of the interruptions or about 7 percent of the total.

Lifting Hooks For Meter Cabinets

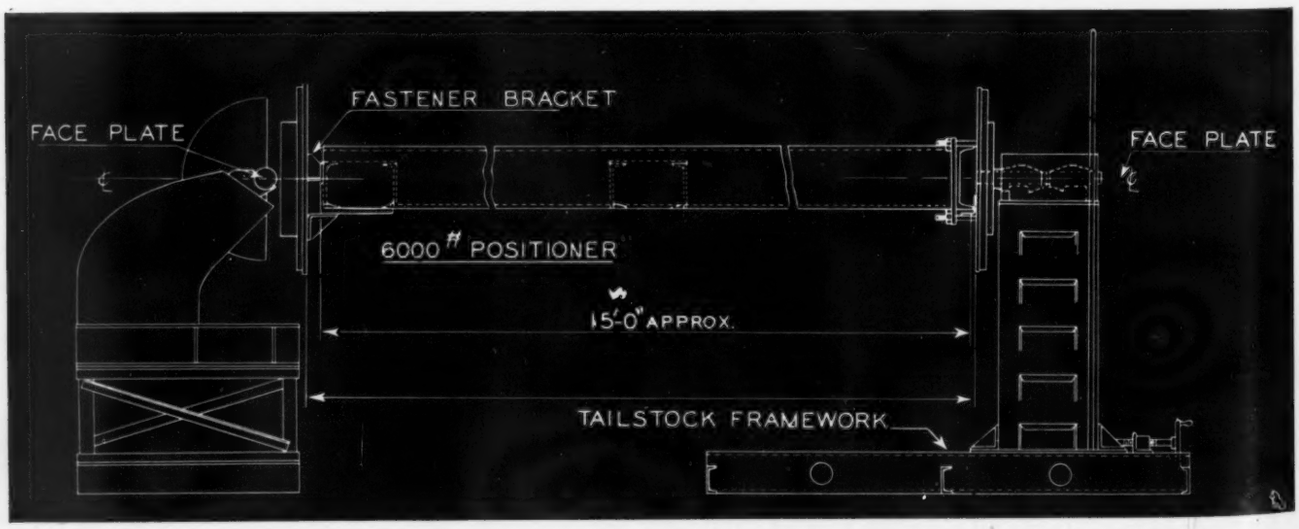
C. W. PINKEL
Illinois Power Co., Belleville, Ill.

It is quite a problem to lift meter cabinets containing instrument transformers into place on a pole or build-

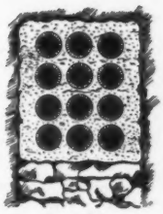


BUSHING BREAKAGE avoided by lifting hooks bolted to meter cabinets, one forward and one toward rear for balance. Here shown down 1-in., 6-in. long, in 3¼-in. from edge of 40 x 15-in. cabinet with transformers mounted

ing, due to the weight of the cabinet and the difficulty of tying a rope or sling on to the cabinet. In some cases when the cabinet was to be hung on a crossarm on a pole or a rack on a building, a rope sling was fastened around the cabinet and the rope sling



ADJUSTABLE TAILSTOCK (right) used with electrically driven 6,000-lb. positioner (left), permits rotation for downhand welding



FOR today's and tomorrow's needs of the public utilities industry, Rome Cable Corporation produces wire and cable products of long-proved dependability. In design and construction they embody the practical application of enlightened research and manufacturing skill. Conductors and insulations possess in full measure the electrical properties required for specific use of the product and are developments of many years' experience.

Our line includes:

Bare and Weatherproof Wire
Transmission Strand
Rome Synthinol*
Service Entrance Cable

ROME SYNTHINOL*

*Trademark registered. Thermoplastic synthetic insulation.

ROMEY SAYS: "Compare the Bulk!"

CHECK THESE IMPORTANT FEATURES:

Rome Synthinol, thermoplastic resin-covered control cables are smaller in diameter, lighter in weight; easier to handle; acid, alkali, moisture and oil resistant.

Cables can be coded in eight distinctive colors.

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ROME CABLE CORPORATION

ROME • NEW YORK

Scovill Tube News

Vol. 4 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 1

Laboratory Services Trace Conditions Affecting Condenser Tubes

An important part of Scovill's service to users of condenser and heat exchanger tubes is the facilities of its laboratory, available to you for the tracking down of conditions causing tube failures.

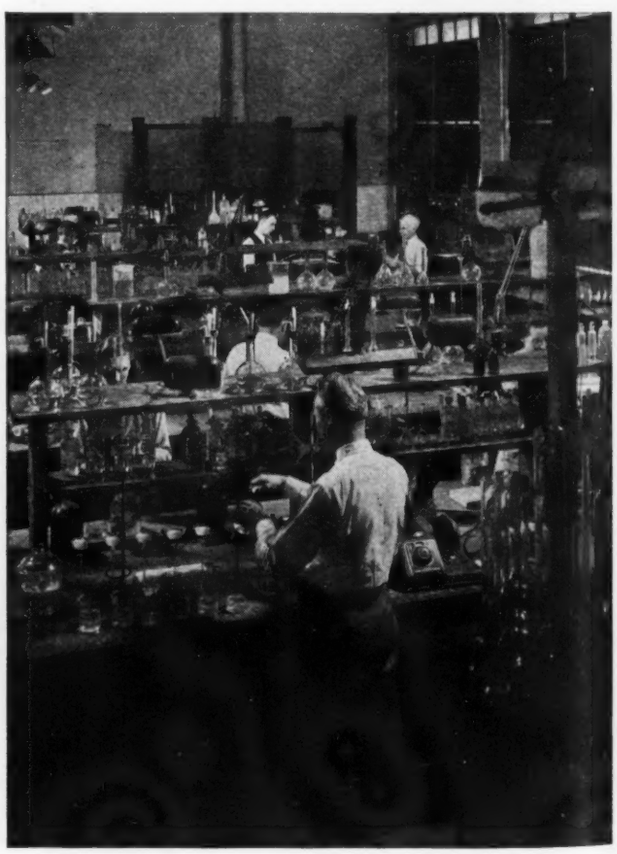
Experienced personnel, operating modern equipment, perform tests and determinations necessary to arrive at the chemical, metallurgical and physical facts concerning the tubes which will eliminate guesswork in studying application problems.

Pictures on these pages offer a tabloid account of what our laboratory is prepared to do for you. They illustrate services which are rendered in addition to the standard specification tests made on individual orders.

Analyses of Elements — Unidentified samples of compounds, corrosion products, deposits or

alloys — sometimes as small as the head of a pin — are analyzed spectrographically to determine the elements present. After classification, a sample might be partially or completely analyzed in this *Spectrographic Department* or turned over to the Chemical Department for complete analysis of the elements as identified. Special spectrographic technique not only can trace concentrations of elements as low as 0.001 per cent, but also assures identification of all determinable elements present in unknown samples.

Performance Predictions — Spectrographic results plus the results of analyses made in our *Chemical Department* can reveal conditions

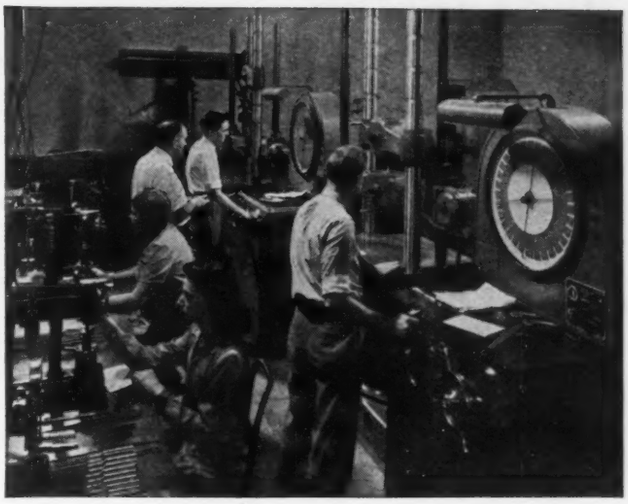


likely to cause early tube failures. The chemists in this department analyze ferrous and nonferrous alloys, corrosion products, deposits, compounds, circulating waters, condensates, paints, and oils to help establish the facts and details associated with a tube application problem.

Metallurgical Structure — Metallographic examination of a tube at from 50 to 1000 times magnification reveals subsurface defects, possible unsoundness, inclusions, and improper grain structure. Such an examination, made in our *Metallurgical Department,* also reveals the nature of the metallurgical structure. This knowledge is important, for a tube material that is chemically

as specified may have metallurgical defects that cause early failure. Microscopic study of tube surfaces also reveals certain tube corrosion characteristics not visible to the unaided eye. Also, the characteristics of cracks as viewed microscopically indicate their probable causes.

Testing for Faults — An important part of the metallurgical data, necessary in establishing the facts to work with in studying a tube problem, is the physical and mechanical testing of the



material as performed in our *Physical Department*. This information, coupled with metallurgical examination, quickly tests the quality of the tubes in question. Subsurface defects and hairline cracks are readily made visible by methods established in this department.

Three Scovill Services

The laboratories shown here constitute a part of our *Service in Metals* which also includes the production of many tube alloys, and the selection of the proper alloy for specific operating conditions. *Service in Men* provides specialized consultation on individual tube application problems and suggestions regarding installation practices. *Service in Manuals* covers literature prepared from the wide experience of our engineers and laboratories to give you the latest, most authentic information on condenser and heat exchanger tubes; for a free copy of our Condenser Tube Booklet, address Scovill Manufacturing Company, 24 Mill Street, Waterbury 91, Conn.

SCOVILL

This is Number Seventeen in a series of Scovill advertisements to help you get longer life from condenser and heat exchanger tubes.

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men

Where and How to Use *Crapo* Steel Conductor

Ask for This Guide to Low-Cost Rural Lines!

If future plans call for the extension of rural service, be sure to ask for a copy of this Manual! A study of its contents will show where and how *Crapo* Steel Conductors can be used to profitable advantage in rural distribution systems.

This illustrated book contains pertinent data on the electrical characteristics and electrical performance of these unique conductors. It shows how construction costs can be reduced by the use of long spans, gives initial and final sag and tension data, describes construction practices, cites typical installations.

***Crapo* Steel Conductors are especially applicable to rural taps and branches where construction and maintenance costs are important considerations. The experience of a number of leading utilities over a period of years shows conclusively that *Crapo* Steel Conductors are giving dependable, economical and efficient service on thousands of miles of line in rural areas.**

Crapo Steel Conductors are distributed by Graybar Electric Company, Inc. Ask a Graybar representative for a copy of the *Crapo* Steel Conductor Manual or write direct for Manual No. 110-C.

Indiana Steel & Wire Company
Muncie, Indiana

Crapo
Steel Conductors

wound in between the insulator bushings to keep it from sliding off the cabinet. In this case the bushing absorbed most of the weight of the cabinet. Sometimes this caused the bushing to break or the rope would slip out of place.

In order to overcome these difficulties and yet have a simple way to hoist the cabinet, we use two "J" hooks. One hook is bolted to each side of the cabinet near the top. Hoisting time can be reduced materially and in addition the hooks on the side of the cabinet increased the safety factor many times. All our cabinets are being equipped with these hooks before being sent out on the job.

•

Fluorescent Lamp For Christmas Trees

By using neon-krypton mixtures for the coral and maize lamps, and argo-krypton mixtures for the blue and green lamps, in the recently developed Sylvania Christmas tree lamps, the resonant lines of these gases lying in the Schumann region are put to work. No mercury is used.

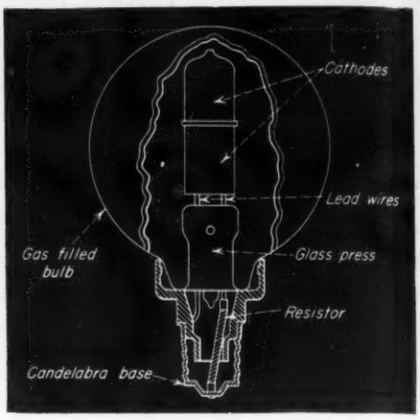
By using such rare gases, the lamps become independent of ordinary air temperatures and therefore may be freely used outdoors in winter weather. This is not true of mercury since it tends to return to its normal liquid state whenever the temperature of the bulb is at low temperatures.

Careful selection of gases also helped to keep the glow discharge voltage suitable below the 120-volt standard. This eliminated any need for a starting device and opens the way for mere resistance control of the discharge. The resistor used is quite small and there is ample room to conceal it in the base. The base with its accompanying flare is the result of glass bulb limitations, since it is impractical to "neck" large bulbs to a diameter small enough to fit into a candelabra base without sacrifice of strength.

The bulb is of the size and shape known as G-16, which means it is globular and 2 in. in diameter (16-one-eighths of an inch.)

The long thin cathodes suggest other possible bulb shapes. They are sturdy and will stand reasonably rough handling—due to a lava disc which separates them and yet locks both together as an integral unit.

Although the lamps are marked for a.c. operation, it is possible to use them on direct current without particular harm. But normally the standard 120-volt d.c. circuit hasn't sufficient potential to start the glow. If the



CANDELABRA BASE Christmas-tree lamp has resistance control in series with cathodes. No mercury vapor used; new phosphors, gas-filled bulb

lamps are started on direct current, only one electrode will glow, with a loss of uniformity over the bulb surface and a somewhat lower output.

•

Unburned Furfural Residue Creates Disposal Problem

Decomposition of unburned organic matter, fired along with powdered coal in the boilers of Cedar Rapids Power Plant of Iowa Electric Light & Power Co. has recently posed a problem in ash disposal and treatment requiring services of a biochemist for solution.

The problem arose with the greatly increased war-time demand for furfural, an essential material used in making synthetic rubber. Formerly furfural was made from oat hulls at the Quaker Oats plant in Cedar Rapids and the residue burned together with coal in the boilers of the adjacent utility generating station. But as the war-time demand for furfural exceeded the supply available from oat hulls it became necessary to use corn cobs as a source of furfural.

Initially the corn cob residue was delivered to the power plant in rather large chunks which were only partially burned in the furnaces. Deposited in the ash dumps, this organic matter began to decompose, producing a malodorous gas.

Decomposition of organic matter in water ordinarily gives off methane or marsh gas, an inflammable but odorless gas. In this case, however, it ap-

NEW PROBLEMS?

C-D improved basic NON-metallics will help you solve them

Many of your "What Material?" problems may be quickly answered by C-D NON-metallics which offer a wide range of electrical and mechanical properties. They provide you with the means of improving product performance, speeding up production, or saving man hours.

The part illustrated is a Vulcoid insulating center for an electrical switch used in mining machinery. Vulcoid was specified because an insulating material was needed that was tough . . . that was resistant to carbon deposit from electrical arcs . . . that would retain its dimensions under humid mine conditions . . . and that could be readily machined.

Other C-D NON-metallics offer exceptional resistance to heat . . . they can be readily FORMED in your own shop by inexpensive forms . . . they are resistant to fungi . . . you should get acquainted with these products NOW, while your engineers are designing new products or looking for means of improving product performance or effecting production economies. Wire, phone or write our nearest office, or send us your blueprints.

C-D PRODUCTS

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DILECTO—Thermosetting Laminates.

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The NON-Metallics

DIAMOND Vulcanized FIBRE

VULCOID—Resin Impregnated Vulcanized Fibre.

MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

RGC-46

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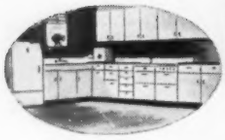
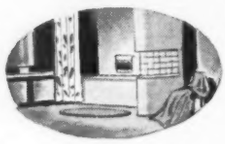
TO MATCH THE HOMES OF TODAY

SMITHway Permaglas

GLASS-FUSED-TO-STEEL

WATER HEATERS





To match the gleaming efficiency, the new conveniences of today's electric kitchens . . .

To match the beauty and convenience of today's modern bathrooms . . .

There's Only ONE *Permaglas*

For the thousands of new homes being built . . . for every present home that will be improved and modernized . . . here is the *one* water heater that meets in every way the new demand for greater convenience, better performance, longer-lasting service.

SMITHway Water Heaters, lined with *Permaglas*—the sparkling blue, mirror-smooth glass-fused-to-steel—resist all tank rusting and corroding under any water conditions. *Permaglas* CANNOT rust or corrode!

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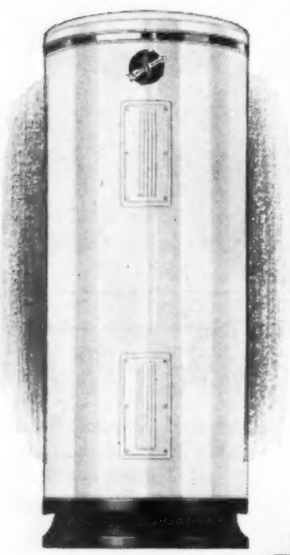
With SMITHway *Permaglas* Water Heaters you have the most powerful *new* sales story in the home appliance business . . .

The monotriad glass-lined heater tank. Sanitary as a sparkling drinking glass. No tank-corrosion in the bath . . . no "tank-spots" on clean laundry. Sparkling clean hot water as pure as the source itself!

SMITHway *Permaglas*
Water Heaters deliver hot water as sparkling clean as the source itself!



HOT WATER BY wire

A. O. SMITH Corporation

NEW YORK 17 • PITTSBURGH 19 • CHICAGO 4 • TULSA 3 • HOUSTON 2 • DALLAS 1
LOS ANGELES 14 • SEATTLE 1 • INTERNATIONAL DIVISION: MILWAUKEE 1
In Canada: JOHN INGLIS CO., LIMITED

SMITHway Permaglas GLASS-FUSED-TO-STEEL ELECTRIC WATER HEATERS

pears that sulphur compounds in the coal ash complicated the picture by producing hydrogen sulphide which has the familiar but unpleasant odor of rotten eggs. In any event, gas bubbles from the lake where ash was being dumped had a definitely unpleasant odor which posed a serious public relations problem for the power company. Size of this problem can be appreciated from the fact that 200 tons of corn cob and oat-hull residue per day were being delivered to the generating station for burning.

Several factors have contributed to a solution of the problem. The cob residue as it comes to the generating station is now much finer and combustion is considerably more complete, although high moisture content is still a problem. It remained necessary, however, to arrest the chemical action between unburned cob particles and sulphur compounds in the coal ash that continued to take place in the lake. Dr. F. W. Mohlman, chemist of the Chicago Sanitary District, called in to consult on the problem, prescribed the addition of sodium nitrate to the lake water to arrest the fermentation there.

In carrying out these recommendations approximately three tons of sodium nitrate were applied by dragging gunny sacks behind a rowboat so that the sodium nitrate would dissolve onto the bottom of the lake. In addition, 800 pounds of sodium nitrate per day were added to the sluice water. The result was a very substantial reduction in the amount of gas given off from the lake and the complete elimination of the objectionable odor. It was Dr. Mohlman's opinion that the fermentation would stop when the temperature of the water dropped below 60 deg. F. About nine tons of sodium nitrate were used for the treatment before the onset of cooler weather made further treatment unnecessary.

•

Transformer and Regulator Job Cost

(From an eastern utility's construction sheets are taken these data regarding work done in an outlying substation)

3 150-kva., 22/2.4/4.8-kv., single phase transformers	$2,773.92
2 Single-phase, oil-immersed, self-cooled, 60-cycle, 50-amp. step regulators	1,525.30
34-ft. of cable with bushings	330.90
9 Cutouts	40.79
Engineering	76.35
Labor	289.14
TOTAL	$5,036.40

MOSINEE is one of the "proved-in-service" materials emphasizing great technological strides in product engineering. MOSINEE is "marching home again" with a creditable "service record" in fields of duty that formerly were unexplored.

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LOAD BUILDING

Commercial
Industrial

Residential
Rural

Club Sponsors Model School Lighting Project

GEORGE D. HANNA
Lighting Service Engineer,
Consumers Power Co.
Flint, Mich.

To focus public attention on lighting conditions existing in most public schools and demonstrate what modern lighting can do for a classroom, the Lions Club of Flint, Mich., last fall spent $3,000 to relight Room 7 in Flint's century-old Walker School. For the project they selected one of the school system's poorest lighted rooms. In it they installed modern recessed fluorescent lighting units, blackboard lighting fixtures, and germicidal lamps to kill airborne bacteria. They also provided for future installation of a photoelectric cell to control part of the fluorescent circuit. Results achieved are shown in accompanying "after" illustration of the room.

While the club's project committee realized that a comparatively good lighting job could have been accomplished throughout the whole school with the money available, it was felt that better results could be obtained if one room could be completely redesigned and equipped with the most modern facilities and the most effective lighting installation. Walker School's Room 7 was selected as the test room with the support and cooperation of the Flint Board of Education and its architectural staff.

The installation, following the recommendations of Nela Park's R. C. Putnam, consists of six rows of single-lamp troffers mounted end to end over the desk area surrounded by a complete square of troffers mounted 24 in. in from the side walls. Troffers are mounted 11 ft. 6 in. above the floor on wooden strips fastened to the 12 ft. 6 in. metal ceiling. This provides better ventilation for the equipment and reduces ballast hum to a minimum. All units are equipped with 3,500-deg. white lamps providing an initial intensity of 90 footcandles, which is expected to drop to about 65 or 70 footcandles after 200 hours. Dimensions of the room are 24 ft. 8 in. by 31 ft. 8 in.

Holophane blackboard units using 100-watt incandescent lamps are mounted over the blackboard area and installed within the continuous rows of fluorescent equipment to maintain the geometrical pattern.

Three germicidal lamps were also installed in the room as an experiment and it is intended to keep accurate records of attendance as affected by communicable diseases so that comparisons can be made at a later date.

Although original recommendations specified baffles for the troffers, this equipment was not available at the time the order was placed. The installation was completed without them, pending possible future addition of the baffles. However, brightness is not at all uncomfortable, because of the deep construction of the troffers which expose only the lamps in the first row or two as one looks across the room.

False Ceiling

To finish off the installation a false ceiling was installed on troffer flanges giving the appearance of a flush mounted job. At the same time units are readily removable for servicing. The room was redecorated in pastel shades. All furniture was removed and refinished in the lightest possible color. Seats were rearranged

Flint Journal

LIONS CLUB COMMITTEE—Sight conservation committee of Flint, Michigan Lions Club, above, check up on the progress of their model school room lighting project at Walker School. By modernizing the lighting in one room the club sought to direct public attention to lighting conditions in most public schools

AFTER—Walker School Room after local Lions Club at Flint, Mich. called in lighting engineers to relight the classroom to modern standards. Installation includes six rows of single-lamp fluorescent troffers mounted end to end and surrounded by a square of troffers; latter has incandescent lamps over blackboard area

Leader

NOW GIVES YOUR MERCHANDISE NEW

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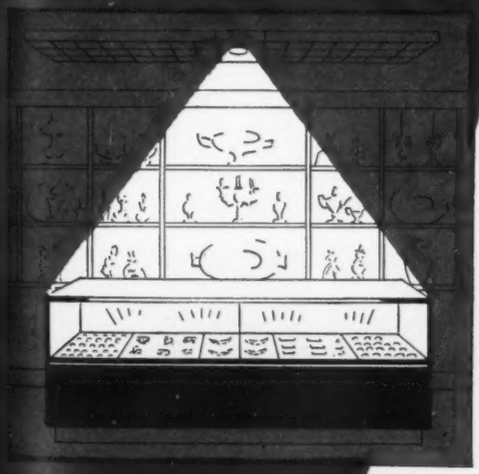
with the New Leader "Officer"

DIRECLITE



It's a well-known rule of merchandising that to *sell* more you must *show* more. Now, with Leader's new DIRECLITE, you can spotlight and focus attention to a given section of your store or a particular item of merchandise. Used in combination with the well-known "Officer" Unit, DIRECLITE gives a selling power unequalled in lighting history.

Previous purchasers will be glad to know DIRECLITE can be easily installed for use with their present equipment.

Leader

Only Better Electrical Wholesalers distribute Officer and Direclite Units. There is a Leader Representative in your area. See him *today*, or write

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6127 NORTH BROADWAY . . . CHICAGO 40, ILLINOIS

WEST COAST FACTORY...2040 LIVINGSTON STREET, OAKLAND 6, CALIFORNIA

to assure maximum benefit from the improved lighting.

Recapitulating, the equipment comprising this installation includes:

1. 58 Curtis 48-in. troffers using 48-in. 3,500-deg. white F lamps.

2. 8 Holophane blackboard units using 100-watt incandescent lamps.

3. 3 Direct germicidal units using 36-in. germicidal lamps.

4. Provision for future installation of photoelectric cell to control fluorescent circuit in outer square in front of windows in north and east walls.

•

Heat Effects on Protective Starters

W. S. MOWRY
Illuminating Engineer
Worcester County Electric Co.
Worcester, Mass.

The lowered efficiency resulting from subjecting fluorescent lamps to excessive ambient temperatures has been recognized by many fixture makers. The effect, however, of such ambient temperatures on the successful operation of protective type starters has only recently been encountered in the field. Factors affecting starter temperatures include inbuilt resistances, location just above the warm lamp, heat generated by lamps and ballasts inside the fixture, normal room heating and natural heat.

It would seem that starter operation should not be affected adversely under normal conditions. Whenever one of the above sources becomes too great a contributor to heating, the ambient temperature can become too high for the thermal tripping element and cause the starter to open the circuit. This allows a starter to go through its safety opening cycle while a good lamp is operating, instead of the cycle's taking place only when normal operations fail to start a deactivated lamp. Since these conditions have been found by trial and error in the field, it is felt that customer dissatisfaction can be avoided by advance information that such temperatures may occasionally be encountered.

One case occurred in a high-ceilinged bank room. In addition to the higher temperatures due to a totally inclosing fixture, a further rise occurred because of fixture location directly on a ceiling with the area bordered by deep beams. This pocket allowed temperatures to reach a point where not only were protective starters found impracticable, but frequent ballast failures were also encountered.

A second instance was that of a large store's show window. The condition of open lamp reflectors in closed windows seemed to allow sufficient temperature to trip the starters. This occurred before late spring or summer weather and could be ascribed to heat pocketing alone. Generated heat could also be combined with long exposure to sunlight and its generous contribution to window temperatures.

In both instances, the reset starters had to be removed and the old type replaced—a return to the possibility of ballast burnouts and of blinking of deactivated lamps.

It may be possible that ambient temperature limitations will be established or that a separate class of protective starter will be developed for such applications. At present there does not appear to be a method that can be offered to the owner of starter-type ballasts for burnout protection under just the heat conditions which are conductive to failures. Possibly such temperature conditions can be better anticipated. It would be well to publish totally inclosing fixture temperatures. More intelligent recommendations as to the adoption of reset starters can be made if one is aware that they have ambient temperature limitations. This can help avoid customer confusion and prevent raising his hopes too high for a new product that may not function as intended.

• • •

Food Service Offers Load Opportunities

H. L. MURPHEY
Industrial Sales
Duquesne Light Co., Pittsburgh, Pa.

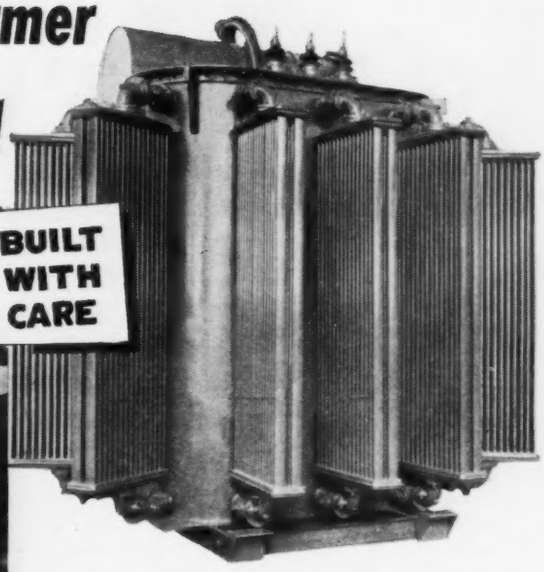
Among developments whose values were demonstrated in the war period, and that will undoubtedly continue in the time of peace, is the business of supplying hot food to industrial workers. This business offers attractive electric load building opportunities.

Such a concern is the Industrial Food Service Corp. which operates a large central kitchen where meals are prepared for distribution to canteens and dining rooms of factories in the Pittsburgh district. Hot meals arrive at the plants hot, coffee, soups and cooked foods being transported in thermos containers.

Installed in the kitchen of the corporation are two 12-kw. electric fry kettles. Their large outputs of fried potatoes, fish, croquettes, etc., keep them operating over long periods of time and make them a desirable load.

OUTPUTS from these 12-kw. fry kettles are packed in thermos containers with other hot foods from central kitchen for transportation to industrial plants

Every AmerTran Transformer could bear this label!



Take Core Stacking for example

CARE in designing and building the cores of large AmerTrans results in reduction of generated heat and noise, and in overall high mechanical strength and uniform flux density.

Care in maintaining corner "squareness"; in eliminating air gaps; in minimizing punch burrs; in shearing tool maintenance—keeps exciting current down, and core losses very low. Highest quality laminations are coated with special flashed on mineral enamel—resists high temperatures, is very thin and resilient.

Clamps are designed for uniform pressure. Clamp bolts are carefully insulated from laminations. Care is exercised throughout—the same care which has played so large a part in maintaining AmerTran's leadership for 45 years.

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178 Emmet Street, Newark 5, N. J., U. S. A.

Gentlemen:

Send me 4-page Bulletin No. 451-01, containing descriptions and prices of AmerTran Portable Testing Sets.

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NEW EQUIPMENT

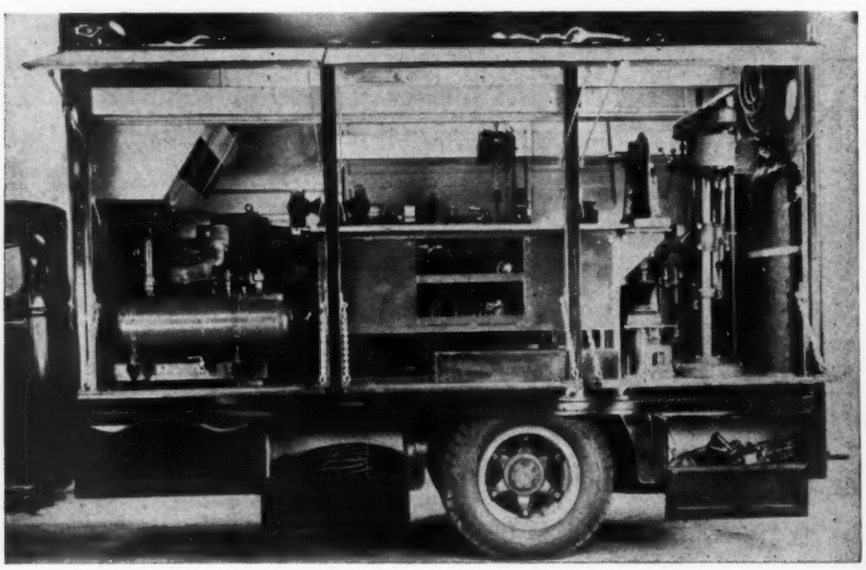
Portable Repair Shop Developed for Utilities

Production of a complete truck-mounted repair shop for use of utilities and other concerns operating over extended areas was announced recently by the Davey Compressor Co., Kent, Ohio.

Suitable for mounting on any standard long wheelbase truck, the shop assembly (known as the Davey Mobile Repair Shop) contains virtually every item of equipment needed for mechanical repair and maintenance work. While it is possible to obtain almost any desired combination of equipment, the company has worked out a number of standard assemblies for the use of specific operators. For example, one assembly includes as its main units a 60-cu. ft. Davey Compressor, a 300-amp. Lincoln welding generator, 5-kw. Westinghouse power generator, a 14-in. South Bend Lathe (with complete lathe accessories and tools), and a drill press of 1-in. capacity. Auxiliary accessories are the same as those found in any stationary machine shop.

The truck body is replete with tool boxes and storage bins. An outside power receptacle is provided for the use of local electric current when available. There are seven inside power receptacles and five interior ceiling lights.

The lower third of the sides of the truck body may be lowered to a horizontal position, where they provide outside work bench space. The upper two-thirds of the body sides are raised to furnish protection against sun and rain for men working outside of the truck at these benches. The body is waterproof and can be locked to prevent tampering or theft.



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Radio Transmits Speech Over Lighting Circuits

Two engineers have invented and produced a radio receiver that, besides providing radio entertainment, also carries the voice over electric light wires from point to point without special interconnecting wires. By plugging it into the nearest electric light-socket, speech can be transmitted to another person who has a similar instrument in another room or office, or on another floor. It is reported that there are no wires to install.

These instruments operate on the principle of carrier-currents, super-imposed on the electric light wires. Each instrument, when talked into, becomes a small radio frequency transmitting station which delivers "wired radio" to the electric light circuits. The voice can be picked up, amplified, and reproduced through a loud speaker.

"Electronx," which is manufactured by Lectradio Corp., 4 St. Francis St., Newark 4, N. J., is automatic in action. The regular radio broadcast stations are reported as received with good quality. The radio cuts out automatically when the radio unit is called by any other unit. It is stated that communication can be effected at all times, even though the receiver is turned off.

•

Fluorescent Units Have Telescopic Frame

Three new recessed fluorescent units with telescopic frames have been announced by All-Bright Electric Products Co., 3917 N. Kedzie Ave., Chicago 18, Ill. Model Nos. REC-240, 340, 440 are all 48 in. long and 11¾ in. wide, and are designed to accommodate two, three and four 40-watt lamps, respectively.

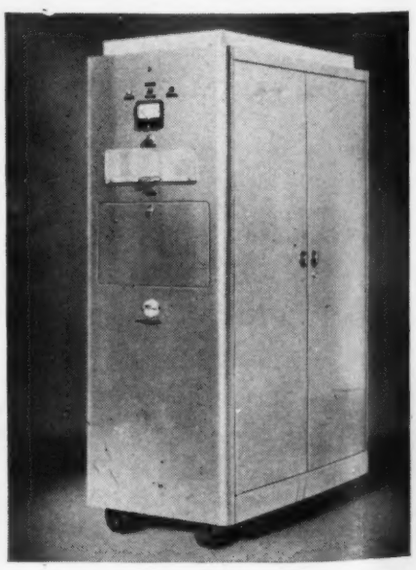
The recessed hinged unit features a telescopic frame that is said to fit snug and flush to uneven ceilings. Special piano hinges and "quick-slide" catches have been incorporated to simplify maintenance. Units are available with either "egg crate" or "honey comb" style louvres.

•

Red Head Unit Output Reported as 5 Kw. at 20 Mc.

Large capacity, compactness and ready portability are among the features reported contained in the new Model 88XO Red Head high frequency dielectric heating unit announced by the Thermex Division of the Girdler Corp., Louisville, Ky. It has an output of 5 kw. delivered at approximately 20 mc. and is reported to raise the temperature of four pounds of average purpose material 170 deg. F. in one minute.

The unit is said to require no manual tun-



WHY?

DO HUBBARD STRAIGHT GROOVE GUY CLAMPS HOLD BEST?

1. **Because:** The **straight groove** eliminates the possibility of drawing a nut tight against an "arched" section which is out of contact with the strand.

Clamping area reduced by warped section. Causes slippage at low strains.

Hubbard Clamps have full clamping area. Hold to breaking strength of most strands.

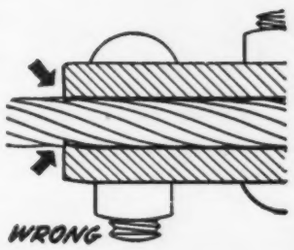
2. **Because:** The **straight groove** fits any and all twists, right or left hand and a variation in diameter without **creating** any high spots to **lessen clamping area.**

High spots in clamp reduce clamping area, cause slippage and injure strands.

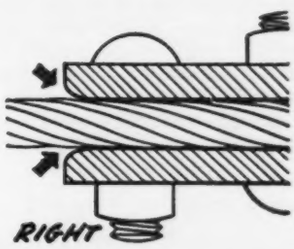
Hubbard Clamps fit snugly over any and all twists, right or left and variations of diameter.

3. **Because:** Bell-end grooves prevent injury to the strand.

4. **Because:** High carbon bolts prevent stripping or elongation. Heads are locked against turning while tightening—and the whole clamp is protected against corrosion by the best process commercially used — HUBBARD DOUBLE-DIP HOT GALVANIZING.



Sharp edge from sheared section injures and weakens the guy at end of clamp.



Rounded ends of Hubbard Clamp sections protect strand.

HUBBARD and COMPANY

Pittsburgh Oakland, Calif. Chicago

ing during the heating cycle. Controls are behind an access door in the front panel and predetermined settings are made by the foreman or inspector and the door locked to prevent tampering. A green light indicates that the unit is ready for operation. The press operator loads the tray with preforms and closes the drawer. This automatically turns on the high frequency energy and a red pilot light shows as the load is heated to the correct temperature. At this point the pretimer automatically shuts off the power and red light and the preforms are transferred to the press. The preform tray slides to working position or may be removed to feed multiple cavity molds.

The steel cabinet is 27¾ in. wide, 47 in. deep and 79 in. high. The built-in heating cabinet has a 16⅛-in. by 20½-in. preform tray of stainless steel which serves as the bottom electrode. The standard upper electrode is a 12⅞-in. by 14⅞-in stainless steel screen, and other sizes are available within the effective limits of the tray's dimensions. Spacing between the electrodes is adjustable from ½ in. to 4½ in. The drawer accepts preforms up to 4½ in. thick. The unit operates on 230 or 440 volts, 60-cycle, 3-phase power supply and its tube complement consists of one 889R and six 872A's.

Fleepower to 25 In. Lb. Measured on Dynamometers

New dynamometers to measure torque and horsepower of all types of fractional horsepower motors, including fleepower, are now being made by the L. A. B. Corp. of Summit, N. J. These are of the eddy current type with d.c. excitation. Torque loads are varied by rheostat adjustment.

They are reported to save time in both laboratory and production use because of self-damping and self-cooling features, and to be designed for uninterrupted and continuous service and to permit one man operation.

Mounted on an ample base, they are suitable for testing electric, hydraulic, pneumatic or internal combustion motors and flexible shaft transmissions. Either running or stalled torques are measured. They are reported to have no springs or frictional devices and maintain unvarying torque readings for long runs.

The smallest sizes measure torques at speeds up to 15,000 rpm. and up to 10 oz. in.; other sizes measure up to 25 in. lb. Additional capacity is obtainable with external cooling and for short runs.

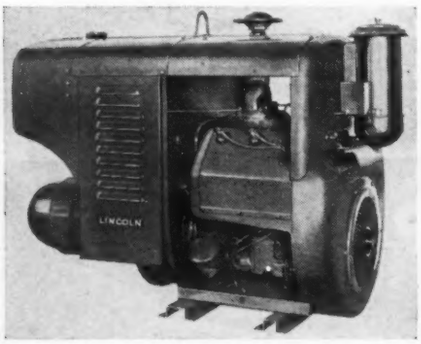
•

Capacity 40 to 250 Amp. Lightweight Welder

A new portable welder of the gasoline engine-driven type which is said to bring to the welding industry a low cost, light weight portable welder is being announced by The Lincoln Electric Co., Cleveland, Ohio. This 200-amp. welder known as the "Shield-Arc Jr." measures 24 x 48 x 30 in. and weighs 660 lb.

With a current range of from 40 to 250 amp., the machine is reported as usable for the welding of light or heavy gage metal, for the repair of cast iron structures such as engine blocks, for the construction of various contrivances or the repair of fabrication of tools and machinery parts, and for hard facing of worn parts.

Among the features reported are: (1) provision is made on the output panel for three ranges of output current, continuous adjustment within these ranges being obtained by means of a simple speed control; (2) generator controls are mounted inside an enclosed cabinet above the generator, cooling being through a fan mounted on the generator shaft; (3) the welder is powered by a Wisconsin air-cooled, 4-cylinder V-type engine. Shrouds around the engine fan and cylinders direct the cooling air. The speed of the engine determines the welding current which is controlled by adjusting the engine speed between a maximum of 2100 rpm. (22 hp.) and 1400 rpm. (16 hp.) Equipped with a 6-gal. capacity gasoline tank, the unit is said to operate under normal welding conditions for approximately six hours before refueling; (4) the complete unit is protected from falling objects by a canopy or shroud which also affords protection from the weather; (5) two transverse mounting rails for bolting to floor or platform permit the welder to be mounted on either shop trailer or high speed road type two-wheel trailer.



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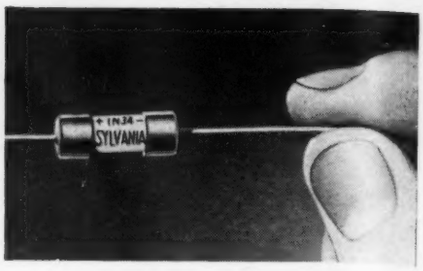
Compact Crystal Diodes Have Many Applications

Germanium crystal diodes suitable for use as second detectors and d.c. restorers in television receivers, frequency discriminators in FM circuits, first detectors, modulators and demodulators, low frequency oscillators, voltage regulators, and polarizing devices have been announced by Sylvania Electric Products Inc., Electronics Division, Boston, Mass.

Other applications include volume limiters, square wave clippers, varistors, noise silencers, meter rectifiers, volume expanders and volume contractors.

Supplied in cartridges measuring 0.75 in. x 0.25 in., they require no heater supply or adjustment and may be wired directly into circuits by means of tinned copper



leads. They are reported as affected less by conditions of temperature, humidity and age than other types of dry rectifiers and to resist shock and vibration.

Electrical features reported include comparatively small inter-electrode capacitance, small shunt capacitance, low forward resistance, high back resistance, ability to work into a low resistive load with reasonable efficiency, and the elimination of heater supply, noise and a.c. hum. Elimination of heater supply permits connection of both terminals of the crystal diode far above ground potential.

Used as a voltage regulator for peak voltages between 20 and 50 volts and currents between 7 and 30 ma. d.c., crystal diodes are said to eliminate flicker, high firing voltage and space requirements of conventional gas-discharge tubes.

Operating characteristics of a typical Type IN34 germanium crystal diode are as follows: peak inverse anode voltage, 50 volts max.; average anode current, 22.5 ma. max.; peak anode current (a.c. signal max.), 60 ma. max.; surge current (transient peak), 200 ma. max.; and back conduction at 50 v., 2 ma. max.

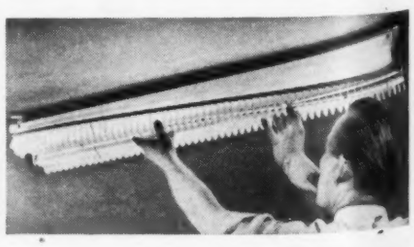
•

Light Diffusor Traps Stroboscopic Effect

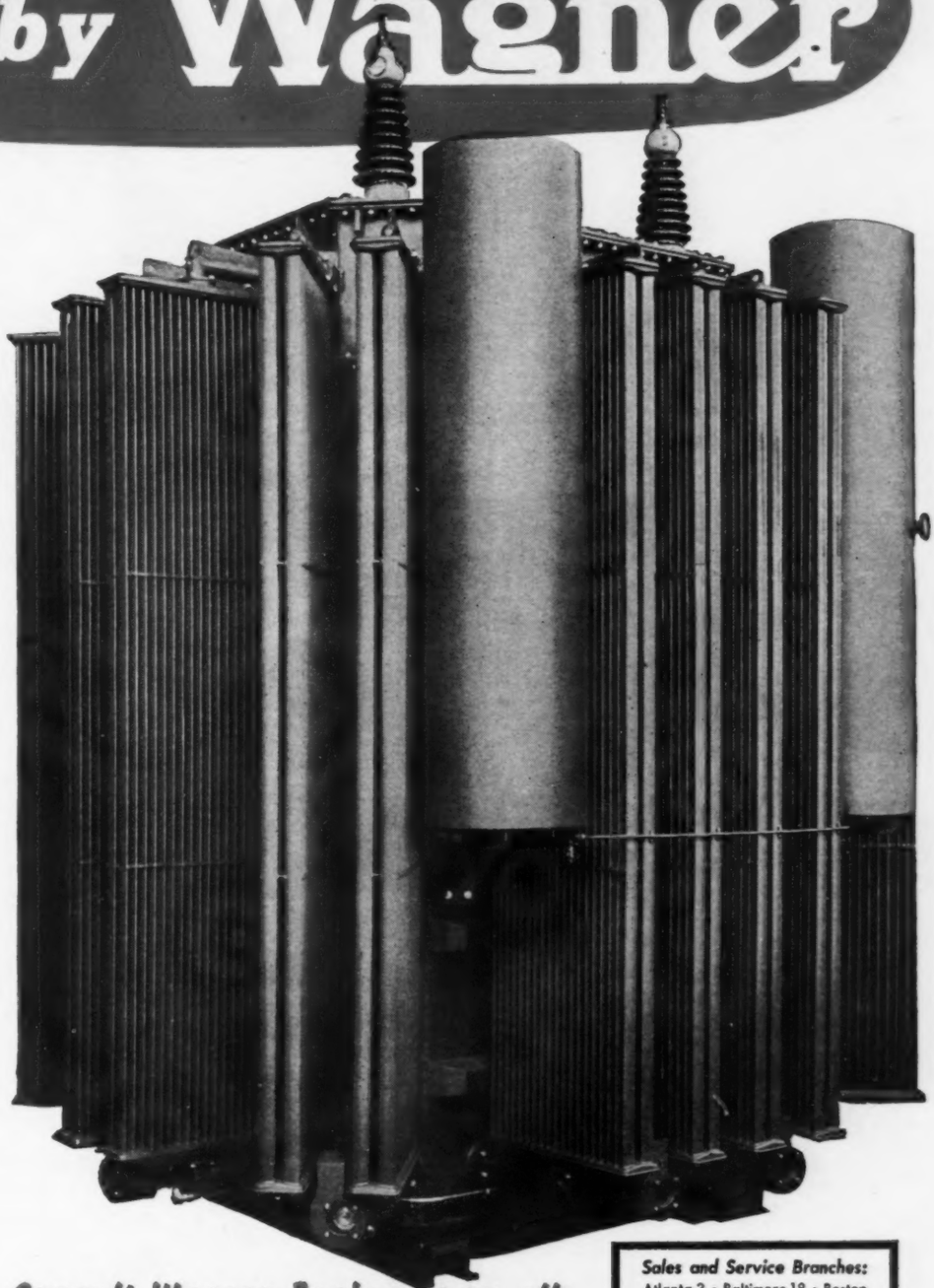
A decorative method of diffusing fluorescent light and eliminating glare is found in a new device which may be attached to fluorescent lamps. Known as the Fluor-O-Shield, this lamp accessory is made by the Canfield Manufacturing Co. of Grand Haven, Mich.

When installed it is reported to improve the appearance of open lamp fixtures, and to eliminate the glare, as well as the "bare lamp appearance" in home and store decorative lighting. This new device is said to cast no shadows and to trap the stroboscopic effect of the lamp.

The Fluor-O-Shield, which is stamped from one piece of light weight aluminum and finished in white baked enamel, fits all open type fixtures and permits strip installations. It is installed and removed by



Built by Wagner



The transformer here illustrated is rated 20,000 kva self-cooled and 25,000 kva forced-air-cooled, one of a bank of single-phase 72,000- to 12,700-volt transformers recently built for a large western utility. It is typical of Wagner design and manufacture, embodying all the latest developments in transformer engineering.

* * *

"Built by Wagner"—therefore representative of the very latest improvements in transformer manufacture, and designed to give many years of dependable, low-cost service for the utility who entrusted Wagner with its manufacture.

Wagner builds a complete line of distribution and power transformers, completely described in Bulletins TU-180 (Distribution) and TU-181 (Power). Wagner Electric Corporation, 6456 Plymouth Avenue, St. Louis 14, Missouri.

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MASTERPIECES *too!*

Schramm #105 Stationary

SCHRAMM

The superior features of Schramm Air Compressors put them in the class of a "masterpiece"! The reasons for this "extra" value in Schramm Compressors are: (1) 100% watercooled; (2) Forced Feed Lubrication; (3) Mechanical intake valve; (4) Compact, lightweight! All features that are designed for heavy duty, continuous service, with minimum attention! Schramm enables you to do your compressed air jobs quickly—easily—economically! Start your compressor planning by writing today for detailed data on Schramm Compressors. Study the details of construction and you will see why Schramms are masterpieces in Compressed Air.

SCHRAMM INC. THE COMPRESSOR PEOPLE WEST CHESTER PENNSYLVANIA

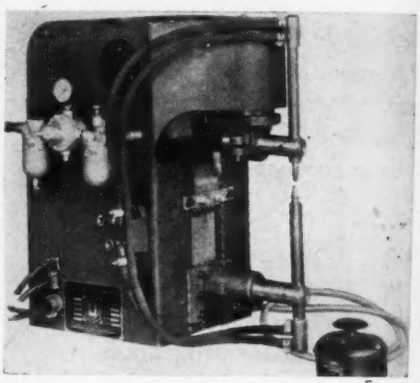
means of two patented snap-on clamps. It is reported to be easily cleaned. The present models may be installed on any standard 40-watt (48-in.) and 20-watt (24-in.) fluorescent lamp.

•

Air-Operated Plug-in Type Welder Developed

Added to the company's line of welders, Davis & Murphy, 5252 Broadway, Chicago 40, Ill., is including a new 7½-kva., air-operated, plug-in, bench-type spot welder.

It includes solenoid valve control of air cylinder, a pressure switch and can be furnished with built-in NEMA 1 A electronic timer. It can also be furnished with NEMA



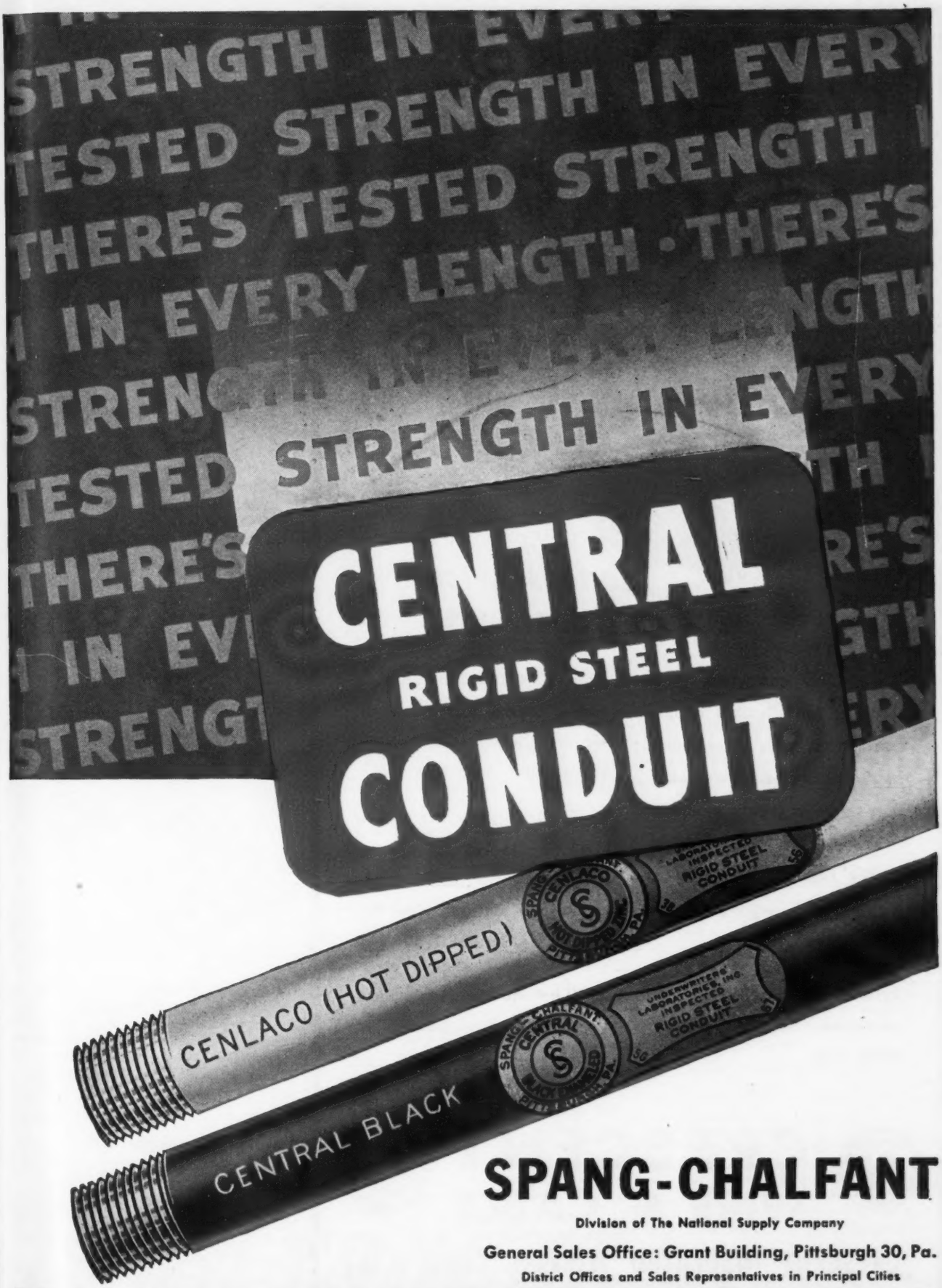
3 B or 5 B in separate timer panel. The solenoid valve control of air cylinder by adjustable pressure switch provides a wide range of uses for welding non-ferrous metals, wire, jewelry and is reported to make possible the welding of two pieces of 16-gage steel. The unit is equipped with air filter, pressure gauge and automatic lubricator. Initiation of welding cycle is by electric foot switch and it is equipped with water cooled transformer and electrodes.

•

Transformer Designed For Use Up to 15 Mc.

A new type RF transformer for induction and dielectric heating has been developed by the Concord RF Corp., Concord, N. H. The new transformer is said to incorporate electrical and mechanical improvements and innovations which result in desirable operating characteristics and efficiency. Mechanical coupling, for instance, is made by the use of a new insulating material which allows a separation of the primary and secondary of only 0.015 in. To guard against breakdown of this insulation, the transformer is "hi-potted" at 25,000 volts RF. This is reported to exceed any voltage to which it will be exposed while in service.

The primary, with a "Q" of around 500 at 3 mc., couples closely into a high "Q" secondary formed in the shape of a large flat doughnut. Another feature reported is the design of the water cooling system and the method whereby conversion from a one turn secondary to a two turn secondary or vice versa, can be made. From the safety



SPANG-CHALFANT

Division of The National Supply Company

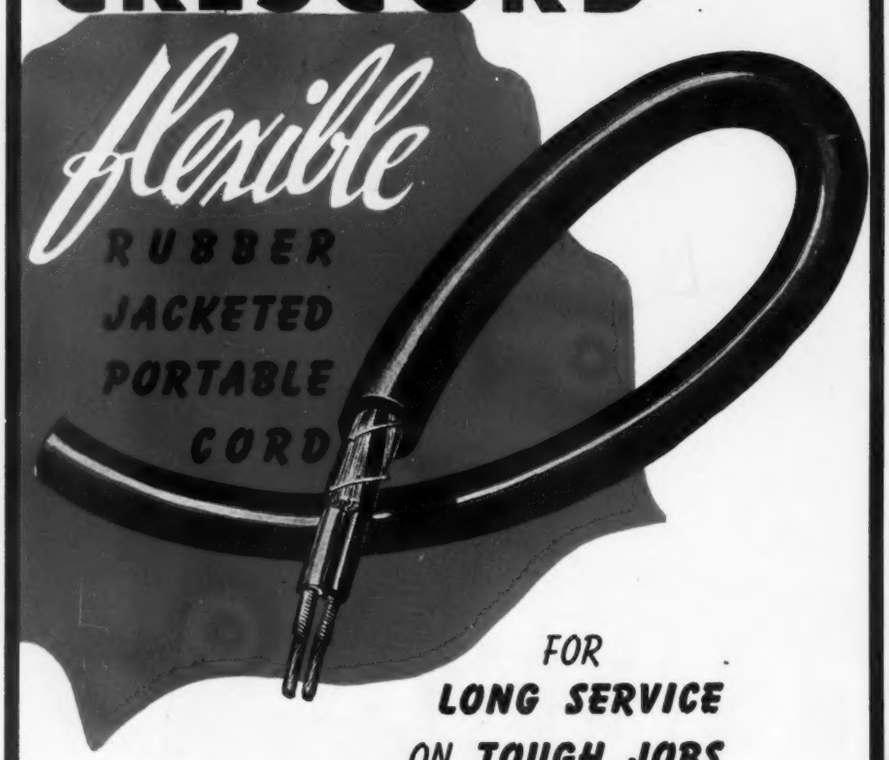
General Sales Office: Grant Building, Pittsburgh 30, Pa.

District Offices and Sales Representatives in Principal Cities

CRESCORD

Flexible

RUBBER JACKETED PORTABLE CORD



FOR
LONG SERVICE
ON TOUGH JOBS

CRESCORD comprises two, three or four flexible copper conductors, with color-coded, heat-resisting, rubber insulation under a tough, synthetic rubber jacket. It is flexible, highly resistant to abrasion, crushing, cutting, water, weather and sunlight.

Type S. CRESCORD has a heavy jacket for maximum life on portable drills, tools and industrial equipment.

Type SJ CRESCORD has a lighter jacket for use on household and office appliances. It is made in sizes No. 18 and No. 16 AWG only.

Type SV CRESCORD is a small, light, extremely flexible cord for use on household vacuum cleaners. It is made in Size No. 18 AWG only.

CRESCENT WIRE & CABLE

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

standpoint the transformer is reported to protect the operator from shock or burn.

Test data show an efficiency of delivery of RF power from generator to lead of 74 percent at 3.5 mc.

As for frequency range, the same transformer works at both 500 kc. and 4.25 mc., the range of the RF generators available. Instrument test shows that this range can be extended to about 15 mc. This feature is said to make possible the manufacture of transformers in standard frequency ranges, namely, 100 kc. to 900 kc., 1 mc. to 10 mc. and 10 mc. and up. The transformer finds applications with both spark and vacuum tube RF generators. Variations in the design can be used for 3 to 10 kc. motor generators. Ratings from 300 watts to 30 kw. are available.

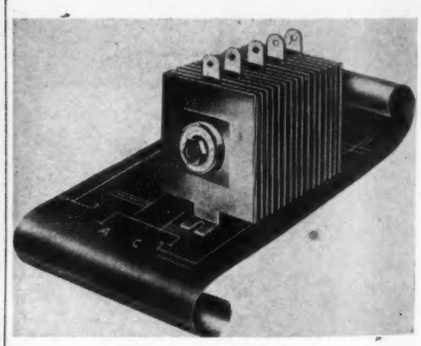
The design of the new transformer permits its use in converting dielectric heaters to induction heating. It is then a simple matter to convert the same RF generator to either induction or dielectric heating as may be desired.

•

50-Ampere Rectifier Is Self-Cooling

The Benwood-Linze Co. of St. Louis, Mo., has announced the development of a dry disc metallic rectifier which is self-cooling. This rectifier is rated 50 amp. for 6-volt automotive battery taper charging. Two rectifiers may be operated in parallel from separate transformer secondaries to provide 100-amp. maximum charging rate without a fan.

Battery chargers of this type (designed to



charge 6-volt batteries) operate from the usual 110-volt a.c. power supply, to deliver the required direct current to the battery. This new rectifier is reported to make possible the design of fast battery chargers rated 50 amp. without any moving parts.

•

Test Equipment For Television Sets

Release of a "B" Sweep Calibrator Model No. 8127 for commercial use in radar and television test work is announced by United Cinephone Corp., Torrington, Conn.

This instrument provides calibration marks for use in calibrating the sweep speed of a synchroscope or triggered sweep oscilloscope. The markers consist of short video pulses, of less than ½ microsecond duration, spaced

Better Trucks for YOUR Business!

"Exceptionally Good Service from Our Fleet of Fords"

When you choose Ford Truck equipment, the soundness of your selection rests on a great deal more than the thrifty purchase price. In hundreds of communities, through every state in the nation, fleet after fleet of sturdy, reliable Ford Trucks have rolled up many millions of miles of carefully-audited evidence of efficiency in public utility service.

Superintendent S. J. Sibley of the Electrical Department, City of Springfield, Illinois, writing not long ago regarding transportation in his department, remarked: "*Our fleet of Ford cars and trucks has given exceptionally good service at a low operating cost, and required no unusual amount of maintenance.*"

In considering the question of new truck equipment, we urge you to let your Ford Dealer present the full facts about the many new engineering advancements in the new Ford Trucks. They are designed to provide greater Ford economy than ever, to make servicing easier and more economical, and to give these sturdy vehicles still longer life.

Ford

ADVANCED ENGINEERING IN NEW FORD TRUCKS

More Economy and Endurance
Easier Servicing

A STILL GREATER 100 HP V-8 ENGINE with NEW Ford steel-cored Silvaloy rod bearings, more enduring than ever in severe service • NEW aluminum alloy cam-ground 4-ring pistons for oil economy • BIGGER, more efficient oil pump and IMPROVED rear bearing oil seal • NEW longer-lived valve springs • NEW improvements in cooling • NEW efficiency in ignition • in carburetion • in lubrication • in ease and economy of servicing operations • And available in all truck chassis except C.O.E. units—the rugged, thrifty 90 HP FORD SIX-CYLINDER ENGINE, with many important advancements.

FORD CHASSIS ADVANTAGES: Easy accessibility for low-cost maintenance • Universal service facilities • Tough, forged front axles • Extra-sturdy rear axles with pinion straddle-mounted on 3 large roller bearings, ¾-floating type in light duty units, full-floating in all others • 3 axle ratios available (2 in 1-ton unit) • 2-speed axle available in heavy duty units at extra cost • Powerful hydraulic brakes, large drums, cast braking surfaces • Rugged 4-speed transmission with NEW internal reverse lock optional at extra cost on light duty units, standard on all others.

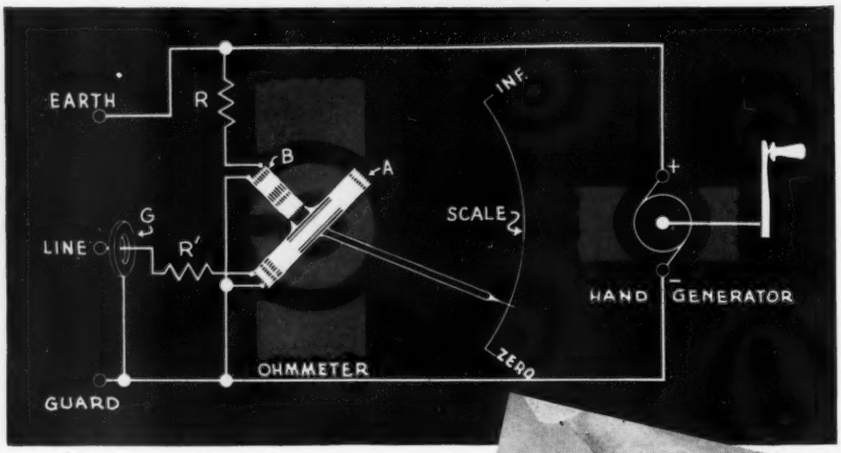
TRUCK-ENGINEERED • TRUCK-BUILT • BY TRUCK MEN

FORD TRUCKS

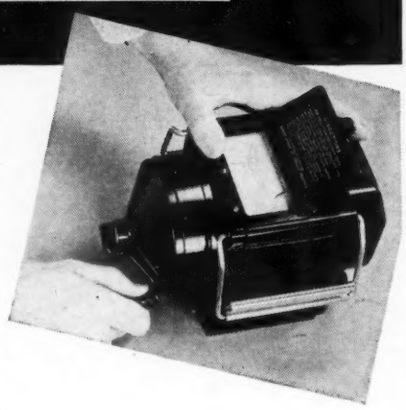
MORE FORD TRUCKS ON THE ROAD • ON MORE JOBS • FOR MORE GOOD REASONS

Here's why—

"MEGGER"* Insulation Testers are always dependable—



In what we term a cross-coil true ohmmeter, two coils are mounted in fixed relation to each other on the same pivot-and-jewel moving system in the field of a permanent magnet. "Current" flows in coil A and "potential" in coil B, and they are connected so that their respective torques oppose each other. Since there are no control springs, the opposing coils give a true ratio of E/I, and ohms (or megohms) are indicated by a pointer over a scale. The readings are independent of the voltage of the hand-driven d-c generator, because any change in the voltage affects both coils in the same proportion.



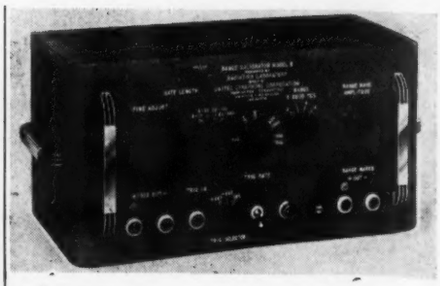
The "Megger" instrument is simplicity itself. The circuit diagram shows *all* elements—hand-cranked generator, fixed resistance coils and ohmmeter with pointer and scale. Nothing more is needed and nothing could be simpler. In making resistance tests, you merely connect leads from the instrument to the apparatus or circuit under test, turn the crank for a few seconds, and read the insulation resistance directly on the scale.

Power generation and distribution practice has dictated certain standards of quality and performance that every piece of electrical equipment is expected to meet. "Megger" insulation testing instruments have been and will continue to be built in conformity with these high standards.

For complete descriptions and applications of all types of "Megger" Insulation Testers write for Catalog 1685-W.

**Tade Mark U. S. Pat. Off.*

JAMES G. BIDDLE CO. • **1211-13 ARCH STREET PHILADELPHIA 7, PA.**



apart by a known number of microseconds.

Switch permits choice of four different time intervals between calibration markers of 2.5, 10, 50 and 100 microseconds. Markers have an amplitude of 40 volts, with choice of polarity. The positive trigger has an amplitude of 120 volts; negative 65 volts. The repetition rate is continuously variable by means of a calibrated control from 2,000 to 3,000 cps.

Operation is from an external trigger pulse, positive or negative, of 66 volts. Gate is reported as a continously variable duration of 20 to 3,000 microseconds. (Gate length is length of time during which markers are generated following each trigger pulse. All markers that would appear subsequent to this interval are suppressed.)

Operates on 110 to 120 volts, 60-cycle circuit and has a power consumption of 65 watts. The unit weighs 23 lb., is 8 in. high, 16 in. long and 7⅞ in. deep.

•

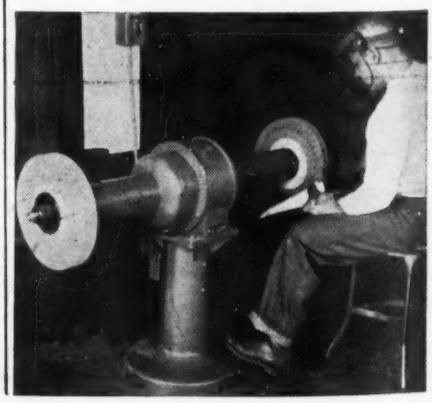
Grinder Designed For Odd-Shaped Pieces

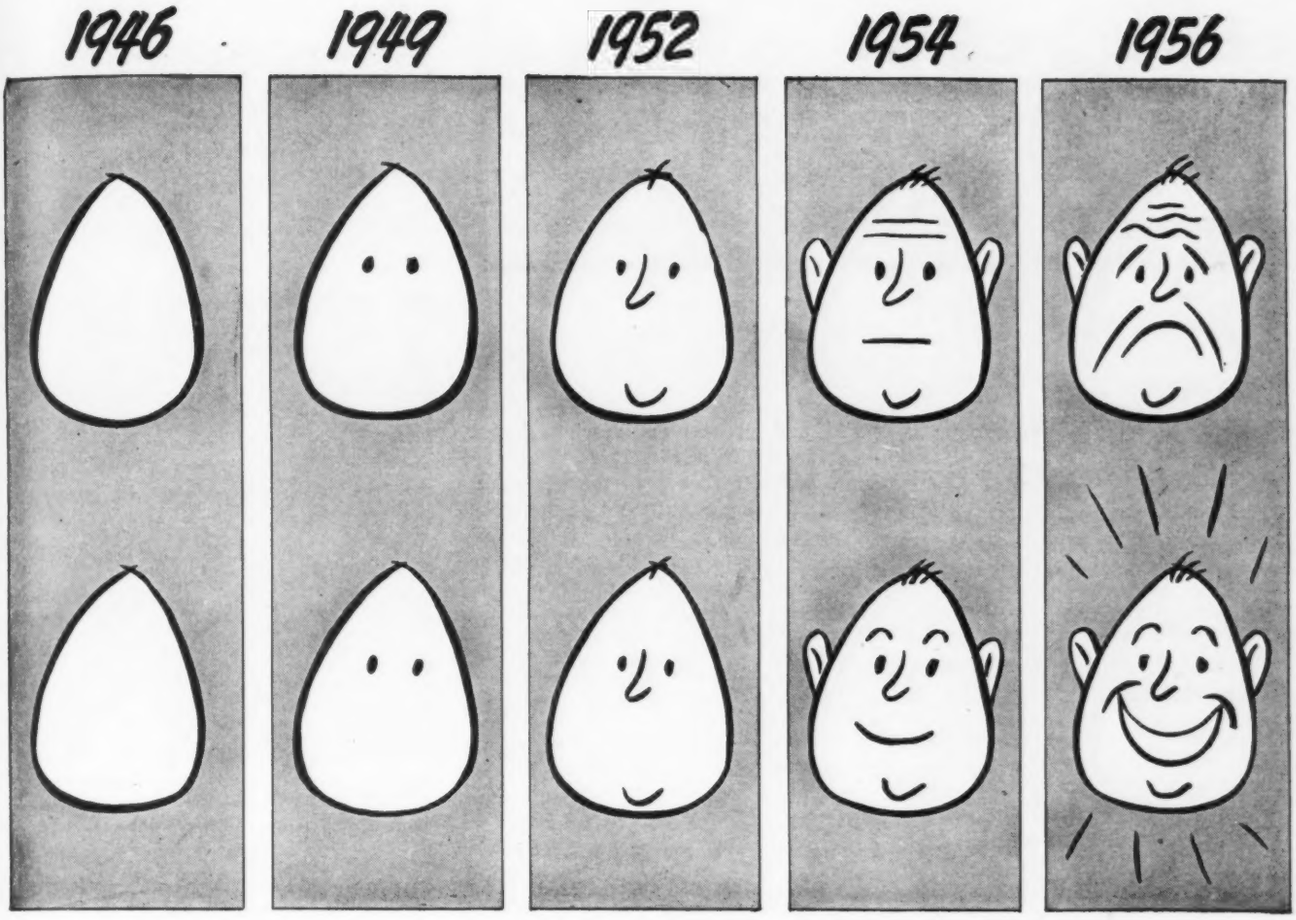
This low pedestal type buffer and grinder was designed especially for use on long, odd-shaped pieces by Hobart Bros. Co., Troy, Ohio.

There is said to be over 40 in. of working space between the wheels and the low design of the pedestal enables the worker to sit at the work and brace the work piece between his protected knee and the buffing wheel.

These grinders are fabricated from steel sheets rolled and electrically welded. The ball bearings and non-stalling motor are fully enclosed. The shaft and motor are balanced and ride on three ball bearings.

The 3-hp. motors are repulsion-induction if single phase, or squirrel cage induction if three phase. They operate at 1,750 rpm. The starting switch is located on the pedestal, just under the motor where it is within easy reach of the operator's hand or knee.





Two ways your face can grow in the next few years

USUALLY, our faces show what's happening to us. For instance, suppose financial matters are constantly on your mind.

Suppose you know that there's practically no cash reserve between you and trouble.

It would be surprising if your face didn't show it.

But suppose that, on the contrary, you've managed to get yourself on a pretty sound financial basis.

Suppose that you're putting aside part of everything you earn . . . that those dollars you save are busy earning *extra* dollars for you . . . that you have a nest egg and an emergency fund.

Naturally, your face will show *that*, too.

There's a simple and pretty accurate way to tell which way your face is going to go in the next few years:

If you are buying, regularly, and holding as many U. S. Savings Bonds as you can, you needn't worry.

Your face will be among the ones that wear a smile.

Buy all the Bonds you can... keep all the Bonds you buy

ELECTRICAL WORLD

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council

NEWS ABOUT PEOPLE

Hodnette Made Manager of Transformer Division

Announcement has been made of the appointment of John K. Hodnette as manager of the transformer division of

J. K. Hodnette

the Westinghouse Electric Corp. at Sharon, Pa. Mr. Hodnette, who has been engineering manager in that division for the past six years, assumes the duties formerly performed by the late H. V. Putman, vice-president in charge of the transformer division.

Outstanding among many transformer improvements for which Mr. Hodnette is responsible and for which he has been granted patents, is the completely self-protected distribution transformer which assures protection against lightning and outages, and minimizes service interruptions. In addition to insulation of high surge strength, this transformer has a de-ion gap that by-passes a lightning surge, a thermally-operated circuit breaker that guards the device against overload, and a signal light that gives visual warning of an overload. For his part in that development, Mr. Hodnette was named a "Modern Pioneer of the American Frontier of Industry" by the National Association of Manufacturers.

For two years following graduation from Alabama Polytechnic Institute, he served as laboratory assistant in the material and process engineering department at the East Pittsburgh Works of Westinghouse, then was transferred to the engineering department of the transformer division at Sharon.

The author of numerous technical articles, Mr. Hodnette is a member of the electric machinery committee of the A.I.E.E.

•

Flahie Heads Underground Department in Toledo

Charles E. Flahie, who for more than a year has been assigned to the engineering department of the Toledo Edison Co., has been appointed superintendent of the company's underground department.

C. E. Flahie

Mr. Flahie began his service with the Edison company in 1926 after a year at St. Joseph's College, Rensselaer, Ind., and the following year he was awarded a Doherty-Frueauff scholarship. He attended the University of Michigan, graduating in 1931 with a B.S. degree in mechanical engineering.

He was then appointed to the Doherty Training School at Denver, Colo., returning to Toledo in 1935, as an engineer in the electric distribution department. In June 1944, he was transferred to the system operating department and later joined the engineering department.

Pacific Gas Appoints New Executive Engineer

James S. Moulton has been named executive engineer of Pacific Gas & Electric Co. to succeed the late W. G. Vincent, vice-president and executive engineer.

J. S. Moulton

A graduate of Yale University Sheffield Scientific School in 1920, Mr. Moulton has been successively a member of the operating department of San Joaquin Light & Power Corp., executive engineer for Great Western Power Co., and, following those companies' mergers with P. G. & E., in 1930, he held the position of assistant to the vice-president and general manager of P. G. & E. until 1940. After that time he was in the executive engineer's department until his entry into the service in 1942, from which he has recently been released with the navy rank of commander.

•

► Dr. Hugh L. Dryden has been appointed assistant director of the National Bureau of Standards. E. C. Crittenden, who has served as assistant director for many years, will continue in that capacity. Dr. Dryden's services will supplement those of Mr. Crittenden. Dr. Dryden joined the Bureau as a laboratory assistant in 1918, and in two years was placed in charge of the aerodynamics section. He was made chief of the mechanics and sound division in 1934. For nearly a year he has been called upon to serve as acting head of the Bureau in the absence of both the director and assistant director.

► Benjamin C. Hill, chief of the Oakland, Calif., electrical department, has retired after 34 years of service in the department, of which he served 26 years as chief inspector and the latter seven as superintendent. Mr. Hill is a past-president of the southwestern section of

(ADVERTISEMENT)

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Cupro Nickel Condenser Tubing

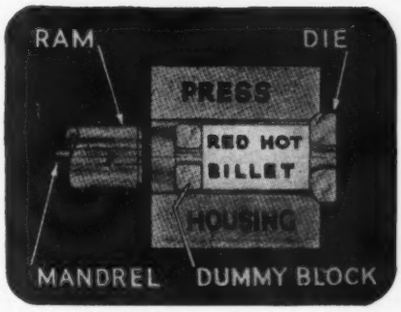
Its Possibilities For Peacetime Use

During the war, the Bureau of Ships specified the use of 70-30 cupro nickel condenser tubes for all battleships and many other types of vessels although both copper and especially nickel were critical metals at the top of the essential list.

The use of 70-30 cupro nickel was based on the results of prolonged tests made under various operating conditions before the war. The Navy had used Admiralty brass condenser tubes for many years until the development of turbine-driven propulsion which necessitated increased speed of the circulating water and caused the Admiralty tubes to fail from air impingement corrosion. Cupro nickel has excellent resistance to impingement attack and also withstands erosion and general corrosion better than brass. Cupro nickel tubing has long been used for feed water heaters because it stands up well under higher operating temperatures and pressures.

Special Equipment Required

The first step in the manufacture of cupro nickel tubes is to cast the alloy in the form of a solid billet approximately 8" in diameter and about 5 ft. long. This is sawed into billets about 9" long which are then heated to redness and extruded to form a tube with a heavy wall.



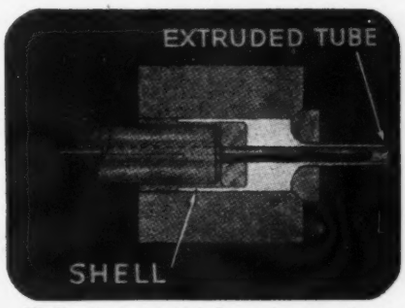
Red hot billet is pushed into the container of the extrusion press, and is confined by the die at one end and by the dummy block at the other end.

After extrusion the heavy walled tube is brought down to smaller diameter and thinner wall by the tube reducing method which is essentially a rolling operation. This is followed by a number of annealing and conventional drawing operations until the tube is finished to the required dimensions which are generally 5/8" O.D. x .049" wall.

Corrosion Resistance Improved

Although straight 70-30 cupro nickel has fine resistance to corrosion from sea water and to stress corrosion cracking from moist ammonia, oxygen, stress and the time element, investigations conducted in the last five or six years have shown that the addition of a small amount of iron is very beneficial in making it more resistant to all types of corrosion from sea water.

English investigators were first to recognize the advantages of adding about 0.3% to 1% iron and approximately 0.5% manganese. Our own tests conducted at Kure Beach, North Carolina, were published in the Transactions of the Electro Chemical Society, Volume 87, 1945, "Corrosion and Biofouling of Copper-base Alloys in Sea Water," by C. L. Bulow. A copy of this paper is available upon request. The addition of 0.30 to 0.50% iron and 0.50 to 1.00% manganese was found to be distinctly beneficial for retarding impingement, pitting and general corrosion from sea water. The results of our tests are shown graphically in the chart in column 3. As a result, all Bridgeport cupro nickel condenser tubing now contains both iron and manganese as specified by the Bureau of Ships, Specification 44T39 (INT) August 14, 1941.



While the mandrel floats in the die the main ram pushes the red hot metal between the die and the mandrel, forming a heavy walled tube.

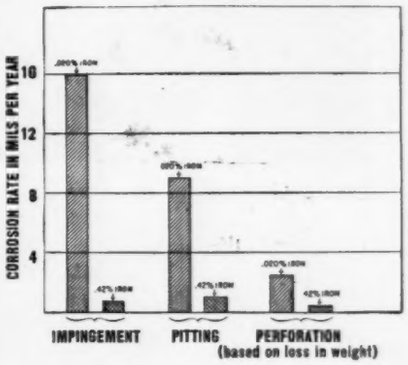
Thermal Conductivity

70-30 cupro nickel has a lower thermal conductivity than brass, consequently some designers provide 10% additional condensing surface as compared to brass to allow a safe margin for this difference. On the other hand, there are some engineers who claim that thermal conductivity has little bearing on the rate of heat flow from one fluid to another through a metal wall. The rate of heat transfer is greatly influenced by the thickness or weight of the corrosion film which forms on the metal after the tube is in service for a period of time. Data obtained on clean tubes are therefore different from data obtained from tubes that have corrosion scale. In the case of cupro nickel, its corrosion film is thinner than the corresponding corrosion film found on brass so that its heat transfer properties remain quite constant.

Outlook for Peacetime Use

Will 70-30 cupro nickel be used more freely in the postwar period? Some engineers are studying its possibilities for use on ocean liners and fast turbine-driven freighters that are either in the blueprint stage or under actual construction. They are thinking of the advantages of using a material which intrinsically has greater endurance and therefore permits greater leeway in operation. They know the advantages of fewer shutdowns, less frequent cleaning, less maintenance, longer trouble-free periods between retubing. They are looking forward to using tubing which can stand severe usage without injury, and can be used at higher operating temperatures and with corrosive waters.

CORROSION RATE OF 70-30 CUPRO NICKEL IN CLEAN SEA WATER
Showing Effect of Iron Content on Corrosion Rate



The selection of the correct condenser tube alloy is still a matter of economics and is definitely related to service conditions. In Bridgeport's Condenser Tube Manual an attempt is made to list the properties of each available alloy. To help still further, Bridgeport's Technical Service Department is ready to serve in the selection of the alloy which will bring the greatest satisfaction.

"Bridgeport" BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • ESTABLISHED 1865

the Association of Electrical Inspectors and is also past-chairman of the code and ordinance committee of the Pacific Coast Electrical Association.

▶ S. G. DODSON, of Tift County, Georgia, is the new president of the Colquitt Rural Electric Co-op. Mr. Dodson succeeds W. F. WESTBROOK, of Colquitt County, president since 1940.

•

J. E. Cain Made President of P. R. Mallory & Co.

At a recent meeting of the directors of P. R. Mallory & Co., Inc., Indianapolis, Ind., Philip R. Mallory was elected

J. E. Cain

chairman of the board and Joseph E. Cain president. The action was taken at the request of Mr. Mallory.

Mr. Cain has been associated with the Mallory company for 18 years. He has served as credit manager, treasurer and as vice-president and executive vice-president.

•

▶ JACOB A. KAHN, who retired on January 1 as vice-president and general manager of General Electric Supply Corp., with supervision over the Salt Lake City and Denver offices, was the guest of honor at a luncheon given by the Intermountain Electrical Association at the Hotel Utah, Salt Lake City. Mr. Kahn was praised as a "man who has worked consistently, conscientiously and objectively" for the progress of Salt Lake City and Utah. Principal speaker was George M. Gadsby, president and general manager of the Utah Power & Light Co. Mr. Kahn was given an honorary life membership in the association which he helped found in 1921. He was first president of the organization.

Central Maine Power Co. Reveals Commercial Staff

Central Maine Power Co. has announced the personnel of its commercial department, which will carry out the post-war policies of the company. The announcement was made by Alton T. Littlefield, commercial manager.

Frank R. Bailey, as director of the new farm service division, will push the use of electricity on the farm. Donald A. Fisher, as director of the service division, will have charge of all appliance servicing and will establish practices and policies of such servicing.

Frank R. Gethro, sales supervisor, will coordinate the commercial department's various activities between the administrative offices and the field, including power, lighting, servicing, and merchandising, both domestic and commercial. He will also be in charge of the sales training program.

The lighting division, directed by R. W. Hudson, will promote the sale and use of adequate lighting to all customers. Central Maine will sell only lamp bulbs and special package lighting items which will not conflict with contractor dealers.

Power application in all its phases, obtaining new industries, and general assistance to architects and engineers on all power matters will be handled by R. D. Morrison, director of the industrial division.

Albert E. Smith, director of the advertising and sales promotion division, will direct all advertising and sales promotion for the utility and for its 36 stores.

•

▶ MELVIN W. LOCKE has been appointed superintendent of the super-power department of the Commonwealth Edison Co., Chicago. He continues as chief engineer of Powerton station and in addition has charge of the transmission and construction divisions of the super-power department. MYERS M. MAYBERRY has been named superintendent of construction in the super-power department. Mr. Locke started his engineering career with the Nebraska Power Co. In 1928 he went to Powerton, then a part of the Super-Power Co. of Illinois, became assistant chief engineer in 1939 and was appointed chief engineer in 1940. Previous to his recent promotion, Mr. Mayberry was assistant superintendent of construction for the super-power department. He has been with the organization for 18 years.

▶ LEO ROY has been appointed assistant superintendent of the electrical distribution division of the Quebec Hydro-Electric Commission. Formerly assistant superintendent of the power division of the Quebec Power Co., Mr. Roy succeeds the late James R. Robertson. Mr. Roy is secretary of the Quebec section of the Engineering Institute of Canada and a member of the Canadian Electrical Association.

•

Wheeler Reflector Names Barnes Vice-President

H. Alden Barnes has returned to the Wheeler Reflector Co. as vice-president in charge of sales after serving almost three years in the Navy.

Entering the service in 1943 as Lieutenant Commander in the Supply Corps of the U. S. Naval Reserve, Mr. Barnes was stationed at the Navy Yard, Portsmouth, N. H., as officer in charge of procurement and distribution of electrical fixtures and fittings for shipboard use, Portsmouth being the central control point for all Navy requirements for this class of electrical equipment. He served as a member of the Navy Manpower

H. A. Barnes

Survey Board in the early part of 1944, and shortly after his return to Portsmouth from this duty, he was appointed executive officer. He was appointed to rank of full Commander in 1945.

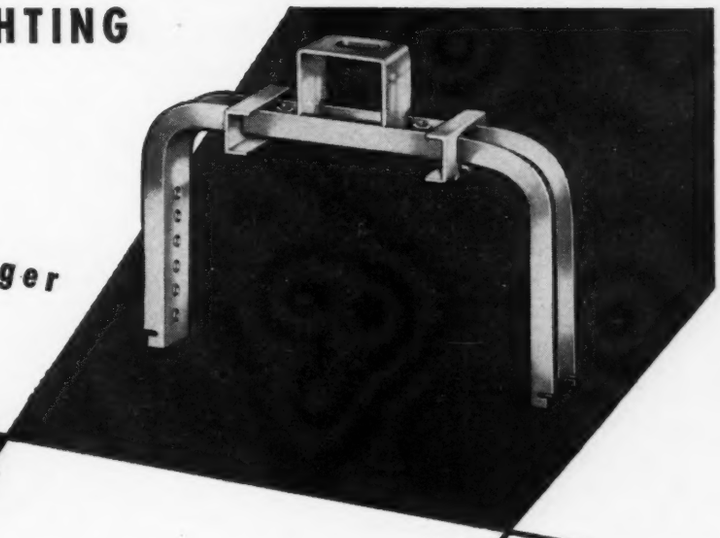
Becoming associated with the Wheeler Reflector Co. in 1919, he was appointed sales manager in 1933. For many years he has been widely known through his activity in the National Electrical Manufacturers Association, the RLM Standards Institute, and many other industrial lighting activities.

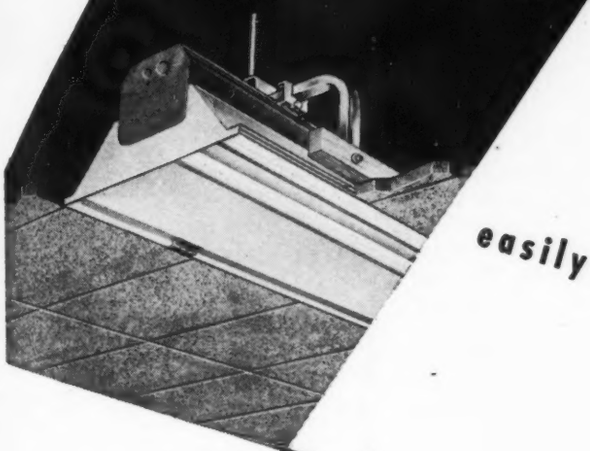
•

▶ CHARLES A. JACKSON, JR., has been named resident engineer for the construction of the $17,400,000 Allatoona dam and reservoir near Cartersville, Ga., according to an announcement by Col.

for VERSATILITY in LIGHTING

this Miller Hanger





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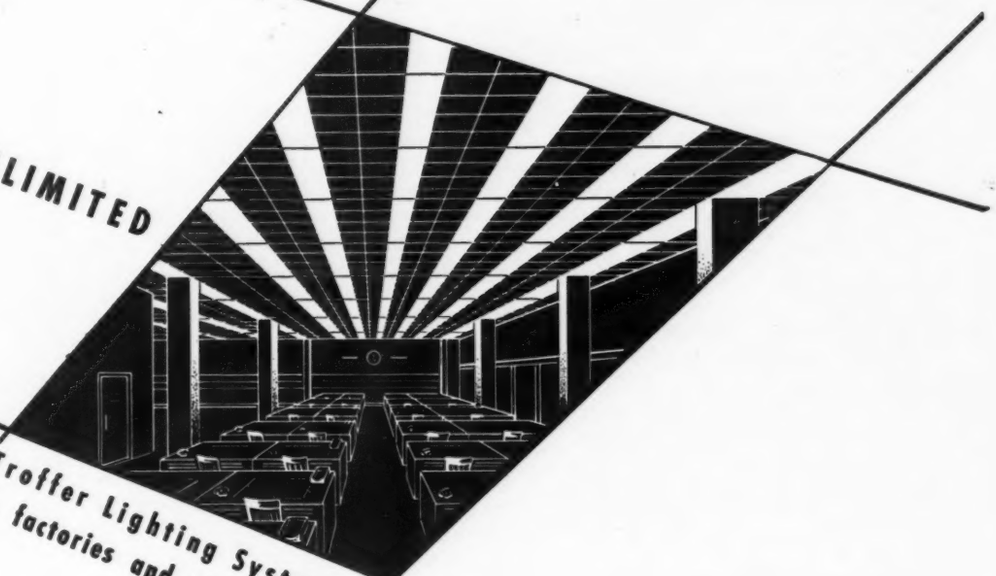


Miller Fluorescent Troffer Lighting Systems for stores, offices, schools, factories and public buildings

THE MILLER COMPANY • MERIDEN, CONNECTICUT

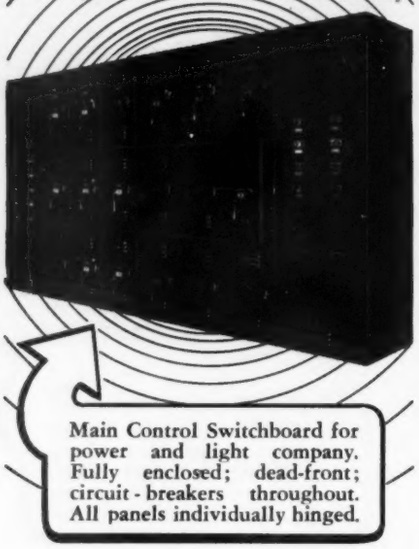
ILLUMINATING DIVISION	ROLLING MILL DIVISION	FOUNDRY DIVISION	HEATING PRODUCTS DIVISION
Fluorescent, Incandescent Mercury Lighting Equipment	Phosphor Bronze and Brass in Sheets, Strips and Rolls	Non-Ferrous Metal Castings	Domestic Oil Burners and Liquid Fuel Devices

MILLER SINCE 1844

Why it will pay you to try

Pelham

for your next Switchboard



Main Control Switchboard for power and light company. Fully enclosed; dead-front; circuit-breakers throughout. All panels individually hinged.

1. Exceptional Engineering Service. The wide experience of our Engineering Department has included the most difficult problems of switchboard design. We can send an engineer to combine our experience with yours in planning a job

2. Highest Standards. The wide preference for Pelham Switchboards is largely due to the knowledge of electrical engineers that "Pelham" on a board definitely guarantees the best of materials and workmanship.

3. Unusual Cooperation. We take full responsibility for meeting all specifications of architects and engineers, as well as municipal, state, or federal requirements. Our deliveries are made when promised.

PELHAM ELECTRIC MFG. CORP.
Erie, Pa.

SPECIALIZED DESIGN

Pelham

UNEXCELLED QUALITY

SWITCHBOARDS • PANEL BOARDS
SWITCH GEAR AND ACCESSORIES

Mark M. Boatner, Jr., Mobile district army engineer. Mr. Jackson recently served as chief of the engineering division of the Seattle district. He became associated with the Army Engineers in 1929.

▶ JOSEPH A. BROPHY has been appointed a member of the New Jersey Board of Public Utility Commissioners to succeed JOSEPH E. CONLON, former president of the commission, who has been appointed by Governor Edge to the Essex County Common Pleas Judgeship.

▶ HARRY F. LOWE, for some time head of the Materials Control Branch of the Office of War Utilities, has been made a partner in the firm of Sloan and Cook, Chicago utility engineers and consultants. Henceforth, the firm with offices at 120 South LaSalle Street, Chicago, will be known as Sloan, Cook, and Lowe. All members of the firm were OWU officials during the war. The business was suspended early in 1942 when members sought to get directly into war work. Founder of the firm, Mr. Sloan, was chief of the Equipment Production Section of the Communications Division until the end of 1944. Mr. Cook was deputy director of the Communications Division.

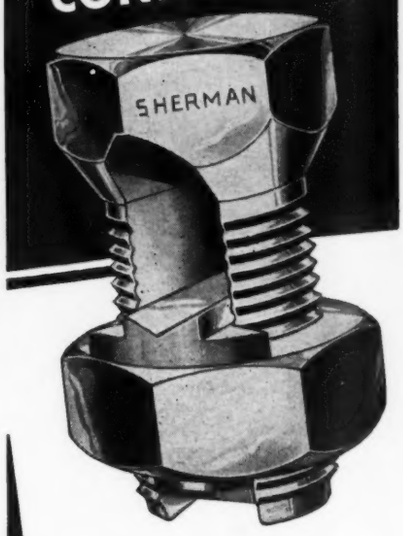
▶ DR. REINHOLD RUDENBERG, professor of electrical engineering at Harvard University Graduate School of Engineering, was made the recipient of an Honor Award by Stevens Institute of Technology at the annual dinner held recently at the Hotel Astor, New York. Dr. Rudenberg was cited for notable achievement in the field of electron optics, as the inventor of the electron microscope. This device played a leading part in research on at least two of the most important war industry problems—synthetic rubber and metal surfaces.

▶ NUMA VIDAL has been appointed manager of the Sharon division of the Pennsylvania Power Co. to succeed Rufus Moses, who has recently joined the Ohio Edison Co. in the capacity of Youngstown division manager. Mr. Vidal was formerly superintendent of power sales for the company. His first employment following graduation from the University of Colorado was with the Duquesne Light Co. as a power sales engineer. In 1927 he joined the Penn-Ohio Power & Light Co. in Youngstown in the same capacity. When the general office of Pennsylvania Power Co. was established in New Castle in 1931, Mr. Vidal was made superintendent of power sales.

▶ W. I. PATTERSON, who has been president of Steel City Electric Co. for 42 years, has retired from that office and been elected chairman of the board. T.

for More Work Per Man Hour

Specify Sherman SOLDERLESS CONNECTORS

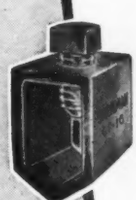


Sherman high strength silicon bronze Service Connector. Die-cut, precision threads. Full hex head, extra thick nut, solid, reinforced spacer.

S-t-r-e-t-c-h those labor hours and get more work done, by using these and other Sherman Solderless Fittings! They not only save time; but they can be installed by less experienced men. What's more, they can be salvaged and re-used.

These Sherman Connectors make strong, efficient, permanent connections. Try them! Let us send you specifications and prices.

Wedge Grip Connector.



"Bond-Rod" Ground Clamp.

H. B. Sherman Mfg. Co.
Battle Creek, Mich.

Type S-O Solderless Lug

For heavy duty service. Extra strong, with large pressure pad and corrugated gripping surfaces.

W. GIBB, who has been associated with the company for 20 years, has been elected president to succeed Mr. Patterson.

▶ A. W. WALTON, for the past ten years protective engineer, generation department, Oklahoma Gas & Electric Co., has been appointed electrical engineer, generation department. Mr. Walton will be responsible specifically for the relay department, dispatching office, and electrical operation and maintenance at the power plants in cooperation with the plant chief engineers. Succeeding Mr. Walton as protective engineer is GERALD E. BROOKS, relay engineer for more than eight years.

▶ PROF. ALBERT A. NIMS has been appointed chairman of the electrical engineering department of Newark College of Engineering, Newark, N. J., to succeed PROF. JAMES C. PEET, retired. Professor Nims joined the department in 1922 after several years of industrial and teaching experience at Worcester Polytechnic Institute, Worcester, Mass., and Cooper Union, New York. Professor Peet is the oldest member of the faculty from point of service, having been associated with the college for the past 27 years.

▶ E. A. TAYLOR has joined the Allied Control Co., Inc., New York, N. Y., as general sales manager.

▶ A. W. GILMORE has been appointed assistant to C. R. Pritchard, general sales manager of the appliance and merchandise department. Mr. Gilmore will assist Mr. Pritchard in connection with sales of G. E. construction materials.

▶ DAVID B. SMITH, director of the Philco research division since 1941 and an outstanding authority on radio, radar and television, has been appointed vice-president in charge of engineering of Philco Corp. Mr. Smith joined Philco in 1934. FREDERICK W. ROTH has been named works manager of the Storage Battery Division of the corporation. Mr. Roth has been identified with Philco since 1933.

▶ V. W. BERGENTHAL has retired as an executive officer of the Wagner Electric Corp., St. Louis, Mo. Mr. Bergenthal, who will continue to serve as a director, has been with Wagner for 41 years, since 1904, when he took his first position with the company as assistant sales manager. In 1913 he was appointed purchasing agent and served in that capacity until 1922, when he was elected a director and treasurer. A founder of the St. Louis Purchasing Agents Association, he served as president the second year and as a director for the first three years. Mr. Bergenthal has been succeeded as treas-

ALL MEMBERS OF THE KLEIN FAMILY

The Klein family of side-cutting pliers, N.E. type, includes five sizes: 9, 8, 7, 6 and 5-inch. They offer to good workmen a tool to fit every job where side-cutting pliers are applicable.

The handsome appearance and modern design are indicative of the high quality and the handcraftsmanship methods that have made Kleins the choice of men who know good tools—for almost a century.

The big husky nine-inch size will handle those tough heavy jobs where weight and strength are needed. The compact five or six-inch sizes are ideal for getting into tight places. Thousands of electricians habitually carry a pair of 7 or 8-inch Kleins —good all-round tools.

Klein pliers are now in production but, of course, the demand exceeds today's supply. Your supplier will enter your order and furnish you with these quality tools as soon as possible.

ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York

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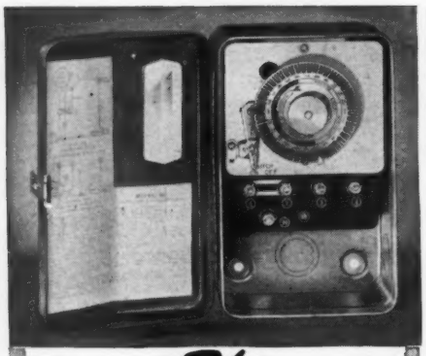

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Here's a top-quality, service-proved ON and OFF time switch. Precision built . . rugged and durable . . . with a great performance record. Highly successful for controlling motors, valves, pumps, blowers, oil burners, stokers, attic fans, commercial lights, etc.

A leader when first introduced over ten years ago, now includes many improvements, one of them being telechron motored. Increased volume and war-learned manufacturing efficiency have brought price down to $10.75 list. Write for complete bulletin:

Paragon 300 SERIES Now $10.75 List

Telechron MOTORED

OPERATING ADVANTAGES

1 Self-starting synchronous operation.
2 Complete self-oiling lubrication, patented capillary oiling system.
3 Years of continuous and uninterrupted operation.
4 Practically instantaneous self-starting at full rated load.
5 Gear reduction fully sealed to exclude dust and dirt.
6 Lower power consumption.
7 Underwriters' approved.

PARAGON ELECTRIC COMPANY
703 OLD COLONY BUILDING
CHICAGO 5, ILLINOIS

Paragon Chicago
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

urer by J. D. EBY, who has been elected secretary-treasurer. Mr. Eby already held the position of secretary, having been elected to that position last year.

▶ FRED W. BUSH has been promoted from assistant to the manager to assistant manager of the electrical department of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., and FREDERICK C. LUDINGTON has been appointed manager of the switchgear and control sections. Mr. Ludington, who joined Allis-Chalmers in 1923, has been acting manager of these sections since the resignation last July of W. S. Edsall.

▶ GORDON J. BERRY, vice-president of Electric Products Co., Cleveland, has been elected president of the Electric Industrial Truck Association.

▶ C. J. PRASHAW has been appointed manager of Frigidaire range and water heater sales. Mr. Prashaw's experience in electrical appliance sales dates back to 1919 when, following his release from the Armed Forces after World War I, he was employed as appliance sales district representative for the Bartlettsville Gas & Electric Co. in Bartlettsville, Okla. His association with the Bartlettsville Gas & Electric Co. continued until 1928 when he was appointed commercial manager of the Missouri Power & Light Co. at Jefferson City, Mo., a position he held until his appointment as general sales manager of the same organization in Kansas City in 1931. After a number of years as refrigerator specialist and district sales manager for the Hotpoint organization, Mr. Prashaw joined the Frigidaire staff in his present capacity.

▶ RALPH B. WILSON, formerly executive vice-president of the Electric Vacuum Cleaner Co., Cleveland, has been appointed manager of manufacturing and engineering of the General Electric Co.'s electric vacuum cleaner division. The appointment follows the purchase by General Electric of the Electric Vacuum Cleaner Co. and the establishment of that organization as a division of the G. E. Appliance & Merchandise department.

▶ CARL O. MARTIN has been made assistant manager, Pacific Coast division, Benjamin Electric Mfg. Co. Mr. Martin has been with the company since 1913, starting as assistant illuminating engineer at the factory. Since 1916 he has been district representative in the San Francisco area. Mr. Martin will make his headquarters at the San Francisco office and warehouse of the company. ARTHUR E. SWEDENBORG has been promoted to the position of asistant sales manager of the central division. Mr. Swedenborg has been with the company since 1922.

▶ GEORGE W. HARTNER has been made sales promotion and advertising manager of the National Electric Products Corp., Pittsburgh. In his more than four years affiliation with National Electric Products, Mr. Hartner has filled several different positions, the most recent being supervisor of the company's priority division.

▶ BURTON R. COLE has been made communications sales manager for the Graybar Electric Co. at executive headquarters in the Graybar Building, New York. Prior to a tour of duty with the U. S. Army Signal Corps from 1942 to 1945, Mr. Cole was manager of the lamp, lighting and supply departments in the Seattle territory.

▶ GEORGE R. LARSEN has joined the Marion Electrical Instrument Co. at Manchester, N. H., in the capacity of development engineer. During the war, Mr. Larsen was associated with the Signal Corps Engineering Laboratories at Fort Monmouth, N. J.

OBITUARY

▶ JOHN J. BROWN, chairman of the boards of Foster Wheeler Corp. New York, and Foster Wheeler Limited, St. Catherine, Ont., died in St. Luke's Hospital, New York, on February 15 after a brief illness. He was 73 years old. Early in his career Mr. Brown was connected with the Consolidated Compress Co. of Texas, the Henry R. Worthington Pump Co. of New York, and the International Steam Pump Co., when Worthington became part of International. It was in 1907 that he became vice-president of the Wheeler Condenser & Engineering Co., New York, and he was elected president in 1918. Upon consolidation of the Wheeler Condenser & Engineering Co. and the Power Specialty Co. as the Foster Wheeler Corp., Mr. Brown was elected chairman. He was a member of the American Society of Mechanical Engineers.

▶ LEONARD H. DAVIS, consulting engineer of Union Carbide & Carbon Corp., died at his home in New York on February 19 after a short illness. He was 73 years of age. Mr. Davis obtained his early experience in the transportation field and from 1901 until 1912 he was associated with the Lake Superior Power Co. and the Tagona Water & Light Co., at Sault Ste. Marie, Ontario, Canada, as chief engineer, later becoming general manager of both companies. In 1903 he also became manager and chief engineer of the Michigan Lake Superior Power Co., Sault Ste. Marie, Mich. This company subsequently became the Michigan Northern Power Co.,

a subsidiary of Union Carbide & Carbon Corp. In 1926 Mr. Davis was elected a vice-president and a director, and in 1929, president of the Michigan Northern Power Co. As vice-president of the New-Kanawha Power Co. and the West Virginia Hydro-Electric Co., he designed and supervised the construction of the large hydro-electric power development on the Kanawha River near Charleston, W. Va., including the dam, tunnel, and power stations, which are now a part of the operations of Electro Metallurgical Co.

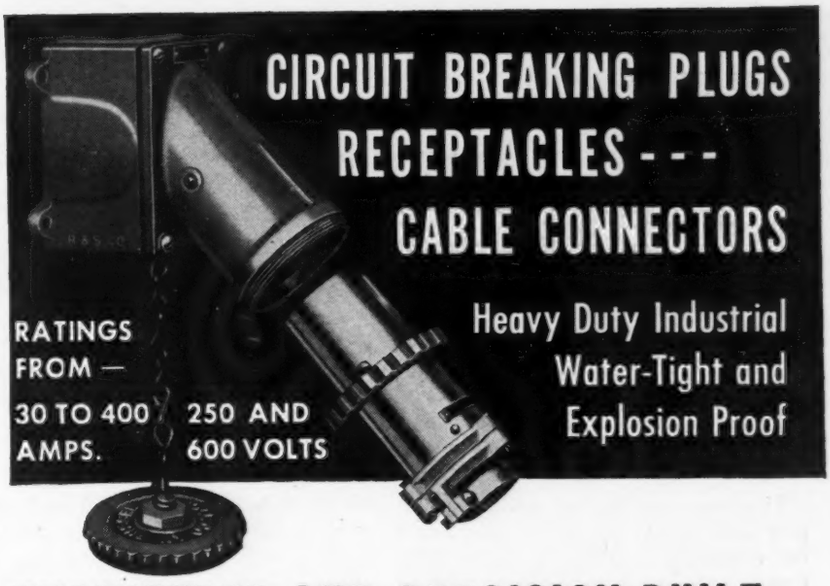
▶CARL HAMBLEN, superintendent of electric distribution for the Central Arizona Light & Power Co., died in a Phoenix hospital on February 17 after a two-week illness. Born in Nashville, Ind., in 1899, Mr. Hamblen was associated with the City of Phoenix Railway Department before he joined the local utility in 1920. Since then he has occupied various positions in the electric distribution system of the company.

▶WILLIAM A. DUFF, president of the Peoples Light & Power Co., New York, and a director of its Texas subsidiary, Texas Public Service Co., was killed in a plane crash near San Antonio, Tex., on February 4.

▶HUBERT P. SMITH, manager of the statistical department, sales and service, Philadelphia Co. and subsidiary companies, died at his home in Wilkinsburg, Pa., after a long illness. He was a native of Columbus, Ohio. Entering the Duquesne Light Co. in 1924 as a cost analyst, he had since served in the following capacities: chief of statistical bureau, statistician, and director of rates, Duquesne Light Co.; director of rates and statistics, manager of rate division, and manager of statistical department, sales and service, the position he held at the time of his death. Mr. Smith was a member of the Engineers Society of Western Pennsylvania.

▶J. PARKER HICKMAN, SR., vice-president of Edison Pioneers, died on February 17 at his home in Asbury Park, N. J., at the age of 79. Mr. Hickman was associated with the late Thomas A. Edison in developing the electric light bulb at Edison's Menlo Park laboratory in 1880. Many years later, long after having left the inventor's employ, he helped to organize the Edison Pioneers.

▶NORMAN A. ROLLINS, retired staff engineer of Commonwealth Edison Co., Chicago, died of a heart attack on February 6 at Manchester, N. H. He was 67 years old. Mr. Rollins became an Edison annuitant in February of last year after completing 40 years of service with the utility.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RECEPTACLES - - -
CABLE CONNECTORS
RATINGS FROM — 30 TO 400 AMPS.
250 AND 600 VOLTS
Heavy Duty Industrial Water-Tight and Explosion Proof

ENGINEERED AND PRECISION BUILT—

FOR SAFE OPERATION

Positive grounding by means of housing and separate contact for safety circuit wire.

Polarized by means of contact arrangement and groove and key in housing. Impossible to insert plug incorrectly.

All contact surfaces are precision machined and adjusted for maximum contact pressure, reducing arcing to a minimum.

Arcing chamber is completely inclosed. Arc is extinguished before plug is completely removed.

FOR LOW MAINTENANCE

Contacts—free floating, self-wiping, stay clean and retain full contact pressure.

Sealed cable grip — no strain on connections. Excludes all dust and moisture.

Ground surfaces and durable oil-resistant gaskets.

Liberal space for wiring, quick and easy access. Facilitates inspection and servicing.

FOR EASE OF INSTALLATION

Substantial external lugs for easy mounting.

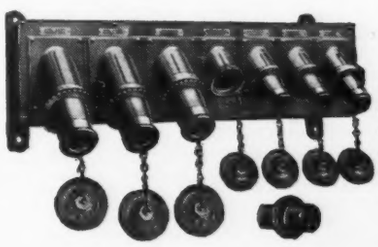
Boxes will accommodate a variety of conduit outlets to suit all job requirements.

Ample wiring space and substantial terminals make wiring easy.

Assembly of interior and contacts requires no special tools.

Interiors do not extend back of covers permits direct assembly to cabinets without internal interference.

A high degree of standardization and interchangeability of parts provides a wide variety of types and sizes to suit every requirement.



SEVEN GANG — Combination of different capacity receptacles.

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32

MANUFACTURING MARKETS

Electrical Equipment Figures Compared

Figures concerning the production, import and export of electrical machinery and apparatus from United States, Great Britain and Germany have been released by Henry H. Fowler, Chief of the Enemy Branch of the disbanded Foreign Economic Administration. The data, which are the latest available, carry some figures for the first year of the war and extend back to the year 1913. Naturally most of the data were obtained from Germany but in some instances comparisons are available in the accompanying tables with similar figures from Great Britain and the United States.

The total production of electrical goods in the year 1935 in the 18 most industrialized nations of the world totaled $2,730,000,000. Of this total the United States, Germany and Great Britain produced $2,315,000,000 or 84 percent. The United States produced 48 percent of the world total ($1,311,000,000,) Germany produced 18.7 percent ($511,500,000) and Great Britain, 18.1 percent ($493,000,000).

Electrical Goods Exports from Germany, Great Britain and the United States

Year	Germany (Mill. $)	Great Britain (Mill. $)	United States (Mill. $)
1913	81.75	39.35	28.10
1925	91.62	79.10	88.65
1929	159.50	100.50	151.85
1933	62.20	33.85	41.25
1934	56.50	37.60	47.37
1935	58.00	43.85	52.75
1936	66.56	49.50	63.42
1937	82.00	60.27	78.62

German Export and Import of Electrical Goods

Year	Export			Import (mill. $)
	Percent of production	Mill. $	Percent to Europe	
1913	.....	81.75	72.60	.....
1925	17.5	91.625	80.00	5.60
1928	23.0	134.00	78.00	12.30
1929	28.5	159.50	70.00	13.40
1932	29.0	88.45	.....	6.36
1933	20.0	62.22	.....	.....
1934	13.0	56.50	79.00	6.92
1935	11.0	58.05	.....	5.17
1936	12.0	66.56	.....	4.54
1937	12.0	82.00	73.50	4.90
1938	11.7	80.27	.....	.....
1939	9.0	75.14	.....	.....

German Output of Electrical Goods in Millions of Dollars and Workers Employed

Year	Output (in mill. $)	Workers	Output Capita (in $)
1925	520.00	266,000	1,955
1928	585.00	320,000	1,828
1929	560.00	317,000	1,766
1932	305.60	183,000	1,670
1933	314.00	190,000	1,652
1934	431.40	254,000	1,698
1935	511.50	287,000	1,782
1936	567.05	312,000	1,817
1937	685.00	359,000	1,908
1938	835.00	430,000	1,942

Cornell-Dubilier Output Close to Wartime Peak

Cornell-Dubilier Electric Corp. reports that gross sales for January totaled $1,881,057, only slightly less than the $2,074,240 reported for January, 1945, when the company was heavily engaged in war work. This compared with gross sales of $275,507 for January, 1940.

Octave Blake, president, stated that output of capacitors was being continued at close to the war-time rate of production because of the many new applications for these products that have been developed since the start of the war. He pointed out that not only had capacitor-type motors become popular once again, but capacitors such as those made by the company were being used in increasing numbers in all kinds of electronic equipment, even toys.

Westinghouse Building "Standardized" Unit

The first "standardized" steam turbine built for electric power generation is in production at the South Philadelphia plant of the Westinghouse Electric Corp., L. E. Osborne, vice-president, revealed recently. The unit is the result of a long-felt need to remove the "custom-made" label from such machines and introduce certain standard sizes and operating conditions.

The project is a 30,000-kw. machine for the Riverview plant of the Southwestern Public Service Co. at Borger, Tex. It will help supply power to oil refineries, numerous carbon-black plants, and a synthetic rubber factory, and will provide power for irrigation facilities in the Texas Panhandle, he said.

Idea Developed by AIEE and ASME

"Paradoxically, steam turbines, which are the source of most of the nation's mass-production power, have themselves always been tailor made," Mr. Osborne said. "This recent development, brought about by a committee organized by the American Institute of Electrical Engineers and the American Society of Mechanical Engineers, is a definite step toward improving the power facilities of the country and at the same time giving more satisfactory service to the public in general."

The six sizes of turbines decided upon by the committee as within the range of the most common of the larger power plant sizes and therefore the most suitable for standardization, run from 11,500 to 60,000 kw. in productive capacity.

"With a plant's productive facilities geared to a definite number of turbine sizes, many types of stock parts—such as blades—can be turned out in quantity for use in future orders or to be kept in reserve as replacements," Mr. Osborne continued.

"We expect, therefore, that eventually this new development will have a twofold result. Certainly it will speed up production and facilitate quicker delivery of equipment to customers than when they had to wait for a 'tailor-

Electrical Exports from Germany According to Categories in Thousands of Dollars

	1925	1929	1934	1935	1937
Generators, motors, transformers, converters	13,555	22,690	6,535	6,745	10,080
Insulated wire and cable	14,600	23,530	5,125	5,570	10,210
Meters and instruments	7,935	10,950	4,470	4,665	5,535
Batteries and accumulators	4,730	6,050	1,085	1,250	1,800
Wireless apparatus	8,070	17,210	6,730	6,650	8,395
Telegraph and telephone apparatus	4,930	9,725	3,145	3,985	4,545
Lamp bulbs	6,705	9,550	2,130	2,405	2,520
Electro-medical and dental apparatus	3,190	5,410	2,200	2,800	4,305
Lighting & ignition equipment for vehicles	19,470	6,635	1,015	635	4,720
Carbons and electrodes	2,280	3,000	4,320	2,190	3,150
Other	6,050	44,750	19,745	21,105	26,740
Totals	91,620	159,500	56,500	58,000	82,000

made' turbine designed and built to their own specifications. It will also be much easier to provide repairs and to service machinery than before.

"Thus, manufacturing processes, when put on routine basis, will be appreciably shortened to bring more satisfactory results to the producer of the equipment, to the company which uses it, and finally to the public in general."

Mr. Osborne emphasized that the standardization program will in no way hinder production of any size of steam turbine-generator needed for purposes for which the standard specifications might not be suited. Neither, he said, will it prevent building duplicates of machines already installed and for which designs and patterns are available.

"Research, too, will be stimulated by this development," the Westinghouse executive declared, "owing to the amount of effort that can be diverted from custom designing to research.

"These preferred standards are subject to amendment from time to time, so they can be continually improved," he said. "At least every year, or at any time when conditions seem to warrant it, the specifications can be reviewed, and whenever possible, improved."

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Increase in Steel Products Prices Is Announced

American Steel & Wire Co. has made the following announcement with respect to increases in the prices of steel products manufactured by it:

OPA maximum prices on steel products were ordered to be increased effective Feb. 15, 1946, in an amount equivalent to $5.00 per ton, and the prices of the steel products manufactured by this company are similarly increased with respect to all shipments on and after that date. Materials shipped after Feb. 15, 1946, will be invoiced initially at prices existing prior to that date and revised billing applicable to the specific increases on the materials covered by any invoice (which may be more or less than $5.00 per ton) will be rendered as soon thereafter as possible. New price lists reflecting these changes will be published as soon as practicable.

•

GM Announces Formation of New Sales Company

E. R. Godfrey, general manager, Frigidaire Division, General Motors Corp., has announced the formation of a new corporation, Frigidaire Sales Corp. This new corporation, a wholly owned subsidiary of General Motors Corp., will have a capitalization of $5,000,000 and

Flexible
HEAT RESISTANT
Varglas SILICONE Products

Now, for the first time, an electrical insulation is available that is truly *high-temperature-resistant*, while still retaining excellent electrical properties, flexibility and high mechanical strength. It is based on the newly developed Silicone resins and is known as *Varglas-Silicone* electrical insulation. *Varglas-Silicone* products will meet the post-war demand for insulation which will remain completely flexible at temperatures as low as -85° F. or will remain stable at temperatures as high as 200° C. or more. *Varglas-Silicone* products have made possible or materially improved many items of war material. Our laboratories which have successfully developed *Varglas-Silicone* Sleeving and Tubing have also been engaged in perfecting our other products to assure you of the finest quality in any type of electrical sleeving or tubing, whether based on Fiberglas, cotton, rayon, nylon or extruded flexible plastics. And we will be glad to quote on any special products based on your own requirements or ASTM specifications.

VARFLEX Products include all types of sleeving and tubing . . Fiberglas, cotton, or rayon impregnated or treated to your specifications or to ASTM and VTA standards. EXTRUDED PLASTIC SYNTHOVAR tubing in formulations for maximum low-temperature flexibility or high-temperature applications. Write to . . .

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will operate Frigidaire sales branches. Officers of Frigidaire Sales Corp. will be announced later.

Mr. Godfrey stated that this new corporation will better handle Frigidaire post-war sales activities and permit national pricing of many of the Frigidaire products to their customers.

•

Refrigeration Group To Step Up Output

In the face of an unprecedented demand for mechanical refrigeration and air conditioning equipment, nearly 100 manufacturers and twice that number of wholesalers will meet in Chicago early this month to discuss ways of speeding both production and distribution.

Plans for four days of conferences, joint sessions and group meetings, to be held at the Stevens Hotel March 4 to 7, have been arranged by officials of the Refrigeration Equipment Manufacturers Association and the Refrigeration Equipment Wholesalers Association. Final details shortly will be announced from REMA executive officers in Pittsburgh and REWA headquarters in Cincinnati.

Among the subjects for discussion will be the impact of material shortages, strikes and other impediments to full production. With the industry's backlog of unfilled orders sufficient to insure capacity output for months, it is the aim of the conferences to work out schedules for faster movement of both complete units and parts through factories and distribution channels to domestic, commercial and industrial users.

•

Carrier Operates at Loss Due to Strikes, Ceilings

Carrier Corp., Syracuse, N. Y., is operating at a loss due to the combined effect of current strikes and price ceilings, Cloud Wampler, president, has informed employees of the company.

Mr. Wampler made the statement in announcing the release of 138 salaried employees to "insure the soundness of our company."

"Since V-J Day," Mr. Wampler declared, "shortages of materials and parts have made it increasingly difficult to finish goods and make deliveries. The company now is operating in the red."

"What has happened," he told those being released, "is no fault of yours or ours. We are simply the victims of a situation that could have been and should have been avoided."

Carrier Corp., has a backlog of orders, totaling $17.8 million, plus another $10 million in orders not entered.

Proctor Electric Now Independent Unit

A corporate separation of the Proctor Electric Co., Philadelphia, from its parent company, Proctor & Schwartz, Inc., effective January 1. was announced recently by Walter M. Schwartz, Jr., president of the electric company. Proctor Electric has been operating as a division of Proctor & Schwartz.

Reasons for the separation, cited in the announcement, are:

1. The completely different character of the electric company's business from that of Proctor & Schwartz, Inc. The former manufactures consumer products; the latter machinery for industrial use.
2. The 550 percent growth of the electric company's business during the last five pre-war years.
3. Need for complete freedom and flexibility of management in dealing with post-war reconversion and marketing problems.

Officers are Walter M. Schwartz, Jr., president; Robert M. Oliver, Joseph W. Myers, Henry Hild, A. H. Caesar, vice-presidents respectively in charge of sales, research, engineering and production; William Battersby, secretary-treasurer. All are members of the board of directors which also includes Ira Jewell Williams and Joseph deV. Keefe.

Proctor Electric Co. is a manufacturer of small automatic heating appliances which are sold exclusively through wholesale distributors. Management, plans and policies will continue without change, Mr. Schwartz said.

•

Dissolves Partnership; Forms New Corporation

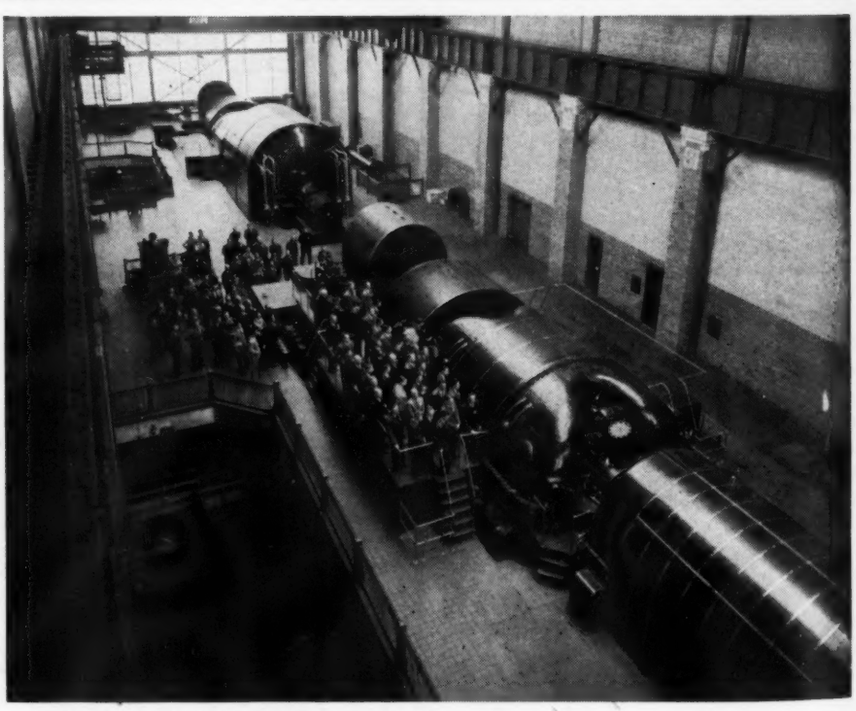
Announcement has been made by the Ideal Commutator Dresser Co., Sycamore, Ill., that the organization has changed to a corporation to be known as Ideal Industries, Inc. As of Feb. 1, 1946, the Ideal Commutator Dresser Co., a partnership, was terminated.

There has been no change in management, personnel, location, manufacturing or methods of distribution of products.

•

Advance Transformer Co. Moves to New Quarters

Advance Transformer Co., manufacturers of ballasts for all types of fluorescent lighting, are moving from their present location at 1161 W. Madison St. to new and larger quarters at 1122 W. Catalpa Av., in Chicago. The new plant will occupy more than 45,000 sq. ft. of space, all on one floor to facilitate improved production lines and increased



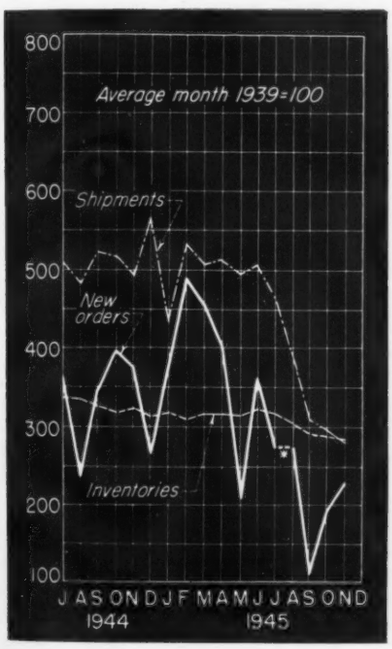
TURBINE EXPERTS HOLIDAY—More than 100 members of the steam turbine department of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., above, are shown inspecting their handiwork during a recent visit to the world famous Port Washington power plant of the Wisconsin Electric Power Co. The group is inspecting one of the two 80,000-kw. Allis-Chalmers turbine units at this plant

efficiency, and this total capacity will be used for the exclusive manufacture of various kinds of hot and cold cathode fluorescent ballasts.

•

November Machinery Orders Increase 16%

The value of new orders received by manufacturers of electrical machinery increased 16 percent in November as compared to the preceding month, according to the report issued by the Bureau of Foreign and Domestic Commerce. The index compiled by the Bureau moved upward to 230 from 198 (revised) in October. It stood at 375 in November, 1944.



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce. *August orders not plotted. Cancellations exceeded orders. Orders Index has been revised by Bureau from 1939 through 1944

Electrical machinery shipments turned downward in November, the index dropping to 280 from 299 (revised) in October; November, 1944 it stood at 492.

According to the Bureau's index, electrical machinery inventories dropped in November—284.3; October, 290.4 (revised). In November, 1944 it stood at 320.5.

•

Renames District Office

The New York City district office of the Kuhlman Electric Co., manufacturers of transformers and Detroit Rocking Electric Furnaces, henceforth will be known as the J. E. Bevan Co., Inc., it is announced at the company's general offices in Bay City, Mich. Location of the office is unchanged at the Graybar Building, 420 Lexington Ave., New York City 17.

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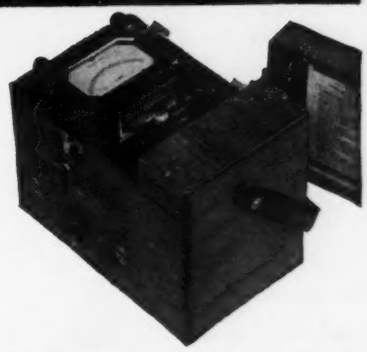

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Field Reports on Business

Though lower levels are reported in industrial output, production figures are running well above those immediately before the war. Present prospects indicate that total retail dollar volume will rise to new all-time highs this year. In the electrical field, accent is on lighting.

NEW ENGLAND

Massachusetts Institute of Technology will spend $9,250,000 on a program of expansion of facilities for research and teaching, according to President Karl T. Compton. Of that total, about $5,500,000 will be available for new construction and equipment as soon as materials can be procured, and of the latter sum, $700,000 will be used for rearrangement of space and for modernization. Among the new buildings projected are a gas-turbine laboratory, a new hydraulics laboratory, and a nuclear science building devoted to research in atomic energy applications. Contributions which will be allocated to the program total more than $500,000 from nationally known companies, including General Electric, Westinghouse Electric Corp., Curtiss-Wright Aircraft Corp., United Aircraft Corp., and General Machinery Corp. Another expansion project directly concerned with electrical equipment purchases and the advance of electrical science announced last week centers at Harvard University.

Machine tool builders are inquiring for electronic control, according to one maker. One manufacturer reports continuance on a large scale of special government research contracts in communications.

Inquiries for heat-treating apparatus are increasing and interest in electroplating equipment has quickened rapidly of late. Institutional lighting jobs loom in large numbers. Street lighting sales should improve with street and highway extensions now under planning. A limited supply of major electrical appliances was quickly sold out by one of Boston's large department stores in one day last week.

PACIFIC COAST

The long-predicted price increase on certain conduit fittings has occurred in an approximate 10 percent price advance to all classes of trade and not passed on from the distributors in their own dollars and cents amount. The $5.00 per ton steel increase, also permitted by OPA, will soon be reflected in rigid iron conduit, though the natural advance will be somewhat offset along the Pacific Coast by a $ decrease in factory freight due to rail-water shipment, now available.

The state-wide efforts of a California industry group to secure adequate wiring from schools, based not only on better seeing conditions but also to prevent future bottlenecks by providing larger raceways and heavier wire, are timely in view of numerous sizable bond issues, almost uniformly successful. These include $1,000,000 for Redlands, $775,000 for Corona, $3,500,000 for Burbank, all in southern California, and $450,000 each for Longview and Snohomish, Wash.

Line material and substation apparatus will also be a big factor in mid-year shipments, because of large and well-distributed power projects, such as new substations and heavier wire in Phoenix region, where Arizona Light & Power Co. is planning $1,000,000 of system betterments; FWA's approval of two 1,000-kw. generators and turbines and 5½ miles of transmission line for Sitka, Alaska, estimated cost being $518,698; and 200 miles of 7,200-volt distribution lines for Ritzville, Wash., region. Backlog of such necessary material is constantly increasing, and construction and maintenance gangs are said to be as much as 30 days behind in many localities, due to material shortage.

NEW YORK

There has been a slight decline in industrial output, as many manufacturers curtailed production because of dwindling stocks of material.

Civil engineering construction volume in continental United States totaled $51,564,000 for the week ending Feb. 21, 1946, as reported to *Engineering News-Record*. This volume was 17 percent above the preceding week and 216 percent above the corresponding week last year.

Popularity of electric trackless trolley and streamlined street cars is depicted in the announcement that General Electric has received an all-time high of orders for such equipment. Of the 2,335 vehicles ordered 1,225 are PCC cars (streamlined street cars) and 1,080 are electric trolley coaches.

Orders for more than 200 of the electric transit vehicles have been placed by Dallas, Tex., Birmingham, Ala., and Oakland, Calif., which are new installations and other cities have ordered from 50 to 600 units to replace or supplement older equipment. Philadelphia Transportation Co. expects to complete its modernization program in a five-year period with expenditures totalling $19,500,000.

CHICAGO

Commercial electric ranges should be available in volume by late Fall, barring production stoppages, according to officials of Edison General Electric Appliance Co. here. This allows for filling all back orders as well. It is expected that purchasers will be able to secure as much stainless steel trimming as desired. Electric counter equipment and new ranges will be on display at National Restaurant Convention in the Stevens Hotel March 26-28.

One indication of a growing market for electricity is the steady rise in building permits issued in the Chicago metropolitan area for January. They totaled $17,607,940, against only $3,298,319 for January, 1945, but were considerably below the $23,493,000 of December last year, when the weather was at its worst for the season. However, January is traditionally the low-ebb building month. The same picture obtains for home-building alone, excluding other types of construction. Significant is the fact that all building in the suburban area in January was far below that of the preceding month, while in the City, not counting Chicago Housing Authority activity, it was $2,000,000 higher, thus reversing the pre-war trend.

Dairyland Power Cooperative, Genoa, Wis., will build a $308,500 steam generating plant at Alma, Wis., for the REA. Kaukauna, Wis., Utilities Commission will build a $60,000 sub-station. Consumers Electric Refrigeration Manufacturers Corp. is erecting a refrigerated locker plant for $40,000 at Orleans, Ind. Illinois Northern Utilities Co., Dixon, will build 108.58 miles of transmission line extensions into a 9-county rural area at a cost of $90,000.

Sales Opportunities

FLORIDA—Florida Power & Light Co., Miami, is arranging an expansion program to be carried over period of number of months for large increase in generating and transmission facilities. Work will include extensions in Sanford power plant at Lake Monroe, with installation of new turbine-generator unit to triple present rating of 12,500 kva., high-pressure boilers and auxiliary equipment. A new power plant is planned in lower East Coast area, on site to be selected soon, with rating of about 42,000-kw., divided into two turbine-generators, high-pressure boilers and accessory apparatus. Work is well advanced on new generating station at Sarasota, to have an initial capacity of 18,000-kw., and this project will be pushed to early completion. New transmission lines will be built for interconnection between various generating stations, including proposed new East Coast plant mentioned; also additional high-tension lines from Daytona Beach to St. Augustine, Fort Lauderdale and Lake Okeechobee district, as well as new transmission circuit between Miami and Fort Lauderdale. Power substation facilities will be enlarged in a number of districts and extensive additions made in distribution lines and service connections for new consumers. Entire project is reported to cost approximately $24,000,000, and is scheduled to be placed under way at early date.

ALABAMA—International Paper Co., Southern Kraft Division, Mobile, bleached kraft papers, plans expansion and modernization in local pulp and paper mill, including several additional buildings, with machinery and electrical equipment for large increased capacity. Also will make replacements in certain present equipment. Entire program is estimated to cost approximately $1,000,000, and is expected to require close to 12 months for completion. Main offices are at 220 East 42nd. St., New York, N. Y.

WISCONSIN—Public Utilities Commission, Manitowoc, R. E. Cannard, general manager, will receive bids until March 18 for new three or four-drum water-tube boiler, rating about 120,000 lbs. steam per hr., for installation in municipal power plant, complete with economizer, superheater, induced draft fan, boiler setting, stack and accessories; also for underfeed stoker for new boiler, with forced-draft fan and auxiliary equipment.

ARIZONA—Bureau of Reclamation, Denver, Colo., will receive bids until March 20 for one 69,000-volt, 600-amp., 1,000,000-kva., three-pole, single-throw, outdoor-type circuit breaker for Indian service substation, Parker dam project, Arizona-California. Equipment will be installed by government (Specifications 1197).

TEXAS—Dow Chemical Co., Freeport, has plans in progress for new power substation for service at local plant, to provide power supply for considerable increased output by the plant.

OREGON—California-Oregon Power Co., Medford, plans call for bids early in spring for foundations and superstructure for proposed new hydroelectric power plant at Toketee Falls on North Umpqua River, vicinity of Roseburg. Station will be equipped for initial rating of 53,600 hp. Power dam will be 35 ft. high, with crest of 350 ft.; a 5600-ft. concrete-lined tunnel will be constructed. Surveys and plans are in progress for new 125,000-volt transmission line from station site to Dixonville, approximately 47 miles, forming part of development. Entire project is estimated to cost about $3,375,000.

INDIANA—Board of Public Works, Columbia City, has plans maturing for extensions and improvements in municipal steam-electric generating station, with installation of new boiler and accessories, cooling tower and auxiliary equipment. Cost reported close to $100,000. Laramore & Douglass, 327 South LaSalle St., Chicago, Ill., are consulting engineers.

CALIFORNIA—Butler Packing Co., 7519 East Marginal Way, Seattle, Wash., prepared food products, has approved plans for new branch plant at San Francisco, comprising a main multi-story building, with electrical equipment, processing and other machinery for large capacity. A power substation and boiler house are planned. Entire project reported to cost approximately $1,000,000. Work on superstructure will begin soon.

IDAHO—Bureau of Reclamation, Denver, Colo., will receive bids until March 19 for one 15-ton electric traveling crane, two motors, for federal warehouse at Anderson Ranch dam, Boise project. Crane will be installed by government (Specifications 1176).

WISCONSIN—Wisconsin Public Service Corp., Green Bay, has surveys and plans under way for new transmission line from Valders to New Holstein, approximately 20 miles. Plan to carry out work in spring.

MISSISSIPPI—Municipal Water & Light Department, Okolona, plans extensions in primary and secondary lines in rural district, with additional service facilities.

NEBRASKA—Water & Light Department, Lincoln, has authorized plans for expansion in steam department at local generating station on 30th. St., to include installation of new boiler and auxiliary equipment. Cost estimated close to $200,000. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers.

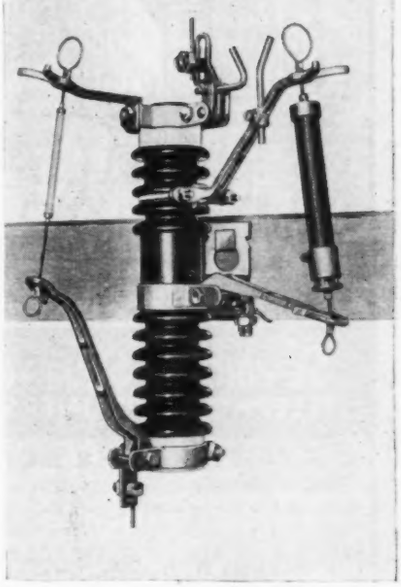
VIRGINIA—Public Works Officer, Norfolk Naval Station, Portsmouth, will receive bids until March 14 for new power substation at local Coast Guard Depot, including underground concrete-encased fiber duct lines and steel conduit, concrete manholes, underground and overhead conductors, etc. (Specifications 17128).

TEXAS—Lower Colorado River Authority, American-Statesman Bldg., Austin, and City Council, Austin, have plans under way for a proposed low-water dam hydroelectric power project in connection with city park development, new station to be constructed by first noted and operated by city.

OKLAHOMA—Public Service Co. of Oklahoma, Tulsa, is arranging an expansion and improvement program in plants and properties to be carried out during present year, including extensions in local generating station, with installation of equipment for increased capacity. Additions to local transmission and distribution systems, comprising both overhead and underground lines, with power substation facilities. Appropriation of about $3,000,000 is being authorized for entire project and work is scheduled to begin at early date.

SOUTH DAKOTA—City Council, Watertown, will receive bids until March 18 for expansion in municipal power plant, including installation of new 5000-kw. turbine-generator and auxiliary equipment. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers.

GAP and FUSE PROTECTION for RURAL LINES



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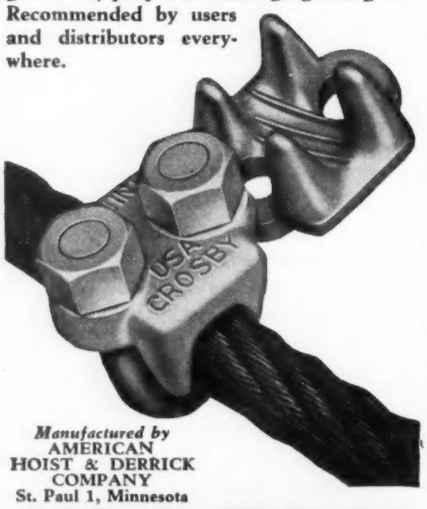

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Recent Rate Changes

PACIFIC GAS & ELECTRIC CO. has been ordered by the California Railroad Commission to reduce its electric power rates $3,310,000 annually. Added to a late slash in gas rates, estimated at $3,500,000, and military and wholesale rate reductions of $680,000, the latest reduction in electricity rates for P. G. & E. brings to a total of $7,490,000 annual savings to customers, largest known to be made by a California utility during a 12-month period. The reduction will affect electricity users in 48 of California's 58 counties, and came as a result of meetings between Pacific Gas & Electric officials and the commission, who had conducted an investigation of the utility's earning records. Of the total $3,310,000 electric rate reduction, $1,150,000 will be applied to ordinary domestic users; $1,430,000 to commercial users; $505,000 to users of agricultural power, and $225,000 applied to the general power service as the result of the change of schedule.

APPALACHIAN ELECTRIC POWER CO. has announced rate reductions over its entire territory in Virginia to the amount of $417,000 annually. The new rates will become effective on May 1. Brought about through investigations conducted by the Virginia Corporation Commission in the past few weeks, the new rates probably will be extended to Appalachian's territory in West Virginia by action of the West Virginia Utilities Commission, a spokesman for the Virginia commission said. Under the new schedules the present rate for residential service is being reduced for consumers of more than 70 kw.-hr. per month to allow total annual reductions of about $70,000. The present rate for commercial or general service for consumers of more than 30 kw.-hr. per month is being reduced by some $198,000 annually. The present tariff designated as "LOP" (large power optional) is being reduced and a new tariff "LCP" (large capacity power) is being offered in Virginia. Reductions will be about $77,000 annually. A revised coal clause on power rates also is going into effect, with reductions estimated at $47,000 per year. Reduced rates for public schools in Appalachian's Virginia territory will bring savings of some $20,000 annually.

BOSTON EDISON CO. has filed detailed rate schedules at the Massachusetts Department of Public Utilities effective March 1, covering reductions to 395,000 residential and commercial customers and aggregating yearly savings of $1,200,000. The first step of residential and small commercial rates has been cut from 6.5 to 6 cents per kilowatt-hour; the so-called "area" rate in residential service is eliminated; and rates affecting large commercial customers have been modified and reduced to promote modern installations for both light and power. Thirty-nine cities and towns are served directly by the company's lines. The company states by chart that the cost of electricity in its territory has dropped to 56 percent of the 1926 level by this new cut, whereas the cost of living (Massachusetts Department of Labor and Industries) has risen about 12 percent from the 1926 base.

SAVANNAH ELECTRIC & POWER CO. has been ordered by the Georgia Public Service Commission to reduce its rates and the commission applied a new principle which eliminates the former discount for prompt payment of bills. Commission Chairman Walter R. McDonald said the newly ordered revisions in residential and commercial rates would save electric consumers $127,300 an-

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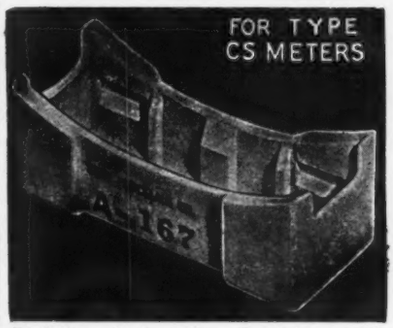

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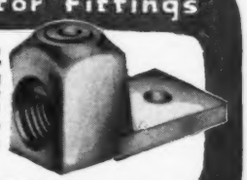

PENN-UNION ELECTRIC CORP.
ERIE, PA.

PENN-UNION

nually. The new rates will become effective on bills which are based on meter readings made on and after April 1, 1946. Cost of service to residential consumers will be reduced by $34,300 annually and to commercial consumers by $57,000. "The elimination of prompt payment discounts will save both residential and commercial users a total of $36,000 per year," said Mr. McDonald.

PUBLIC SERVICE CO. OF INDIANA has filed with the state Public Service Commission a reduced rate schedule, under which electricity users in 70 central and southern Indiana counties will save more than $1,100,000 a year. The savings will amount to more than $772,000 a year for residential and commercial customers. Industrial users will get a saving of more than $268,000 yearly and cities and towns get a rate cut of $120,000 a year in street lighting costs.

VIRGINIA ELECTRIC & POWER CO.'s new rate schedules, recently approved by the North Carolina Utilities Commission, will save residential and commercial customers in North Carolina approximately $100,000 a year. The lowered rates, also applicable to power supplied for small shop plants and for street lighting, will become effective April 1.

JASPER, TEX., city council has reduced electric rates 10 percent for commercial and rural power users. The new rates became effective with January meter readings.

CAROLINA POWER & LIGHT CO. has reduced its electric power rates 10 percent, effecting a saving of approximately $133,000 annually, to customers in South Carolina. The new rates, applicable to commercial, industrial and combined lighting and power customers, became effective March 1. The company serves the eastern part of South Carolina.

Recent Legislation

Among the utility bills on which various state legislatures have taken action recently are the following:

KENTUCKY—By a vote of 24 to 14, the Senate approved amendment of the 1942 TVA Enabling Act with a bill described by the chairman and two directors of the Tennessee Valley Authority as "of disastrous consequences to the people of Kentucky." The bill now goes to the House. Senator Henry Ward, Paducah, leader of opposition to the bill, stopped his fight after two amendments he offered were defeated. (See ELECTRICAL WORLD, February 16, Page 177.)

NEW YORK—A bill has been introduced in the Legislature, amending sections 14 and 15 of the Transportation Corporations Law. The amendment requires gas and electric corporation upon request of consumer to furnish a copy of meter reading or pay forfeit of $25; prohibits discontinuance of service for any cause until after five days written notice with statement of reason therefor. The measure was referred to the Public Service Committee. Another bill introduced in the Legislature adds a new section 679 to the Conservation Law. The new section provides that no public utility may pass over, through or under property controlled by regional park commission without written consent of commission; municipality may obtain license or easement for any public purpose and commission may grant licenses or easement for construction of sewers, laying water and gas mains and electric conduits. The bill has been referred to the Conservation Committee. Amending sec-

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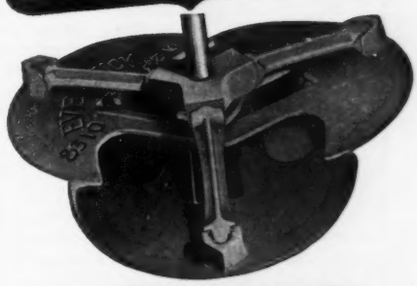

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tion 20-b of the General City Law is a bill introduced in the Senate. The amendment proposes to continue to July 1, 1947, provision authorizing cities to impose tax not to exceed one percent on gross income or gross operating income of corporations and persons furnishing utility services. The same bill has been introduced in the Assembly. A bill, which amends the Public Service Law relative to sub-metering corporations, has been introduced in the Senate. The amendment brings electric sub-metering corporations under supervision of public service commission, limits maximum rate to that fixed for electric utilities operating in same territory and excepts railroads and others generating electricity for distribution on private property to its own tenants. The bill was referred to the Public Service Committee. A measure, amending section 18-a of the Public Service Law, has been introduced in the Senate. The amendment provides if revenues of a public utility are less than $500,000, public service commission may charge more than ½ of one percent, but not to exceed 1½ percent for cost and expenses of proceedings before commission; no additional charge shall be made during two succeeding calendar years except to extent of balance remaining of such 1½ percent. A new plan for development of the power potentialities of New York City's water-supply system has been put before the Legislature in a bill sponsored by Senator Arthur H. Wicks, Kingston Republican, and Assemblyman Thomas A. Dwyer, Brooklyn Democrat. The measure would authorize the City Board of Water Supply, subject to the approval of the Board of Estimate, to lease the use of water in the city's vast reservoirs and aqueducts up-State to private utilities for generation of hydroelectric power. To qualify for such a lease, a utility would have to prove that its own facilities had been impaired by some project instituted to augment the city's water supply and would have to waive any claim made on this basis for damages against the city. As still a further requirement, the utility would have to supply the city with all the power it required for use in the watershed.

MISSOURI—The Senate passed a measure directing the city councils of Springfield and Joplin to establish boards of public utilities to govern city-operated utilities. The measure will be returned to the House for concurrence in amendments which would provide that: mayors and city commissioners would receive an extra $1,500 as compensation for work in connection with utilities; in the city council and six member utility board disagree over disposal of surpluses, the people would have the right to decide by vote; the voters would have the right of recall. The measure also provides that the utility board would regulate and fix rates of the utilities to all consumers, even outside the cities. The House has passed and sent to the Governor a bill which would permit cities of the second class (Joplin and Springfield) to inspect electrical appliances offered for public sale by retailers. Upon passage of the bill, a similar House measure was passed to extend to cities of the third class the inspection privileges.

•

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A dividend of 50 cents a share has been voted on the common stock of the Holophane Co., Inc., for payment on March 22. Payments in 1945 were 35 cents in March, 40 cents in June and 30 cents in October.

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WANTED: CONSTRUCTION Superintendent, power plants. Building, mechanical, electrical experience necessary. Considerable program. State experience, age, salary expected, enclose photo. Middlewest. P-181, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

METER SERVICEMAN and inside wiring inspector wanted on REA project near Denver, Colorado. Must be familiar with test procedure on single and polyphase watthour meters and capable of heading meter department. Must also be familiar with national electrical code requirements for all types of rural wiring. State reference, experience, salary to start and availability. P-189, Electrical World, 520 N Michigan Ave., Chicago 11, Ill.

(Continued on page 154)

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P-187, Electrical World
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POSITIONS VACANT
(Continued from page 153)

ELECTRICAL ENGINEER: Capable of estimating and constructing REA lines, with sufficient field following to develop this department. State age, experience and type of proposition desired. P-188, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: A man under 40, to handle statistics in the Research Department of a middlewestern electric utilities company. Experience should include handling of statistics or college training in statistical analysis. Give full details of education and experience and state salary required. P-190, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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OPERATING MANAGER: 22 years electric utilities experience, 18 years managing private utilities, 4 years managing REA generating cooperative. Practical experience in all phases of utilities operations. University Technical Education. Available for executive position. PW-192, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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ELECTRICAL ENGINEER: age 43, married, 21 years experience, 19 years large public utility. Experience: relays, power plant, substation, large industrial plant layout, testing and maintenance. High voltage transmission, distribution and network studios, operation and supervision. Desires position with established company, western area preferred. PW-197, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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